US ERA ARCHIVE DOCUMENT

ATTACHMENT E: POST-INJECTION SITE CARE (PISC) AND SITE CLOSURE PLAN

Facility Information

Facility Name: FutureGen 2.0 Morgan County CO₂ Storage Site

IL-137-6A-0003 (Well #3)

Facility Contacts: Kenneth Humphreys, Chief Executive Officer,

FutureGen Industrial Alliance, Inc., Morgan County Office,

73 Central Park Plaza East, Jacksonville, IL 62650, 217-243-8215

Location of Injection Well: Morgan County, IL; 26–16N–9W; 39.800266°N and 90.07469°W

This Post-Injection Site Care and Site Closure (PISC) plan describes the activities that the FutureGen Alliance will perform to meet the requirements of 40 CFR 146.93. The FutureGen Alliance will monitor ground water quality and track the position of the carbon dioxide plume and pressure front for fifty years of post-injection site care and may not cease post-injection monitoring and site care until a demonstration of non-endangerment of USDWs has been approved by the UIC Program Director pursuant to 40 CFR 146.93(b)(3). Following approval for site closure, the FutureGen Alliance will plug all monitoring wells, restore the site to its original condition, and submit a Site Closure report and associated documentation.

Pre- and Post-Injection Pressure Differential

The information regarding pre- and post-injection pressure differentials, as required by 40 CFR 146.93(a)(2)(i) is presented below.

The maximum injection pressure differential is 479 psi at the injection well when injection stops. The magnitude and area of elevated pressure gradually decreases over time after injection stops; as further detailed in Table 1.

Figure 1 shows the pressure differential versus time for monitoring well locations in the Area of Review (AoR) and at the geometric centroid of the four horizontal injection wells. Simulated pressures at the injection "point" increase during the 20-year injection period from 1,779 psi to a maximum of 2,258 psi. The highest pressures are in the immediate vicinity of each injection well. As shown, pressures at the injection and monitoring well locations decline over time after injection ceases. Despite the modeled pressure of 2,258 psi, current permit limitations will require the pressure in the injection well not to exceed 2,252 psi.

Figure 2 presents aqueous pressure differentials from baseline at the top of the injection zone and the extent of the carbon dioxide plume at 20 years after the start of injection (i.e., the end of injection) and 70 years after the start of injection (i.e., at site closure).

Table 1. Pressure differential to baseline conditions at well locations near the base of the Ironton Formation for Above Confining Zone Well 1 (ACZ1) and ACZ2 and at the middle of the Mount Simon 11 layer in the injection zone for the rest of the wells during and after.

Pressure Differential (psi)					
Year	SLR1	SLR2	ACZ1	ACZ2	Injection Well
Distance from Injection Well (ft)	3740	6555	1010	3740	0
Elevation (ft)	-3371	-3414	-2763	-2751	-3390
0 (Start injection)	0	0	0	0	0
1	223	125	0	0	350
2	277	165	0	0	394
3	311	192	0	0	417
4	333	211	0	0	431
5	348	225	0	0	441
10	393	274	0	0	466
15	413	313	1	1	475
20 (Stop injection at year end)	425	338	2	2	479
21	255	235	2	2	259
22 (Approximate maximum extent of CO	2				
Plume)	199	186	2	2	200
23	167	157	2	2	167
24	145	137	3	3	145
25	129	121	3	3	128
30	85	81	4	4	84
35	64	61	4	4	63
40	51	49	5	5	50
45	42	40	5	5	41
50	36	34	5	5	35
60	27	26	5	5	26
70	22	21	5	5	21
80	18	17	5	5	17
90	15	14	5	5	14
100	13	12	4	4	12
SLR	R1 Single-	Level in	-Reservoi	ir #1	
SLR	Single-	Level in-	-Reservoi	ir #2	
ACZ	Z1 Above	Confinin	ig Zone#	1	
ACZ	Z2 Above	Confinin	ig Zone#	2	
Injection Well Geometric centroid of four horizontal laterals			tal laterals		

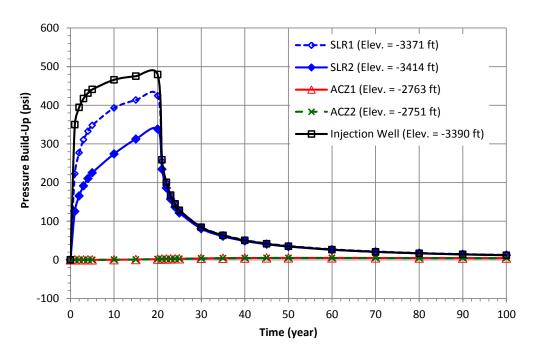


Figure 1. Simulated aqueous pressure differential versus time at monitoring well locations near the base of the Ironton Formation for ACZ1 and ACZ2 and at the middle of the Mount Simon 11 layer in the injection zone for the rest of the wells.

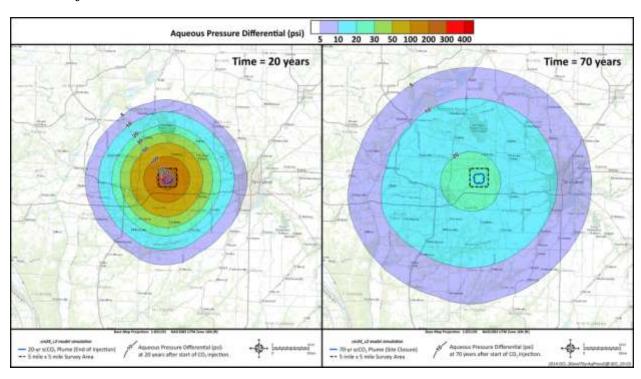


Figure 2. Aqueous pressure differentials from baseline condition at the top of the injection zone and CO_2 plume extents at 20 years (end of injection) and 70 years (site closure) after start of injection.

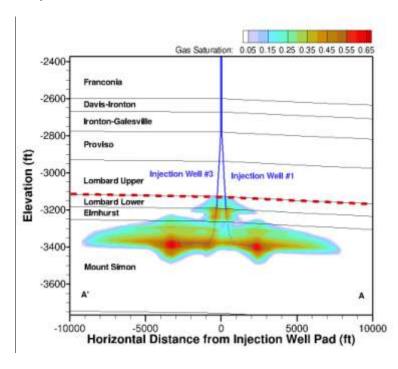
<u>Predicted Position of the CO₂ Plume and Associated Pressure Front Upon Cessation of Injection and at Site Closure</u>

The information regarding the predicted position of the carbon dioxide plume and associated pressure front at site closure, as required by 40 CFR 146.93(a)(2)(ii) is presented below.

The areal extent of the CO₂ plume increases during injection and for 2 years post-injection. As the areal extent decreases (at year 22), the plume migrates predominately upward. The computational modeling results indicate that the sequestered CO₂ will migrate above the Mount Simon Sandstone, into the Elmhurst as well as the lower part of the Lombard.

Figure 3 and Figure 4 show the upward migration of the CO₂ plume near the injection wells at 20 and 70 years. These two-dimensional images demonstrate various levels of gas saturation or upward migration into the injection zone (Mount Simon Formation, Elmhurst Sandstone, and the lower part of the Lombard). The computational model results indicate that the Model Layer "Lombard 5" is the top unit containing a fraction of injected CO₂ during the 100-year simulation. The top of the injection zone is set at 3,153 ft (below MSL) at the FutureGen stratigraphic well, corresponding to the top of the Lombard 5 layer of the numerical model.

The computational model estimates that the CO_2 plume forms a cloverleaf pattern as a result of the four lateral-injection-well design. The plume grows both laterally and vertically as injection continues. Most of the CO_2 resides in the Mount Simon Sandstone. A small amount of CO_2 enters into the Elmhurst and the lower part of the Lombard Formation. When injection ceases at 20 years, the lateral growth becomes negligible but the plume continues to move slowly primarily upward. Once CO_2 reaches the low-permeability zone in the upper Mount Simon it begins to move laterally.



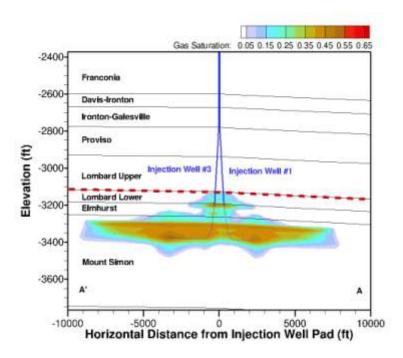


Figure 3. Cutaway view of CO₂-rich phase saturation along A-A' (Injection Wells 1 and 3) at 20 and 70 years. The red dashed line indicates the top of the injection zone.

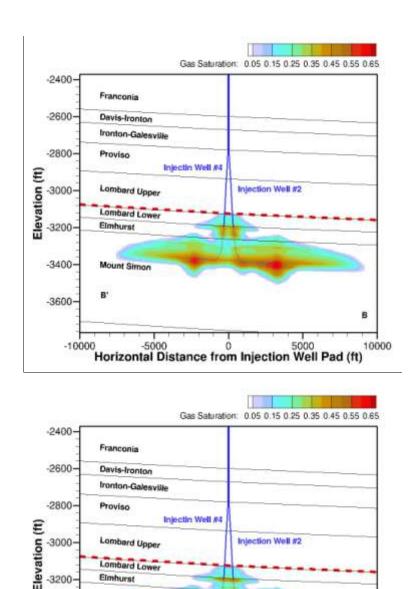


Figure 4. Cutaway view of CO_2 -rich phase saturation along B-B' (Injection Wells 2 and 4) at 20 and 70 years. The red dashed line indicates the top of the injection zone.

Horizontal Distance from Injection Well Pad (ft)

5000

Reservoir conditions are such that the CO_2 remains in the supercritical state throughout the domain and for the entire simulation period. The three-dimensional distribution of the CO_2 -rich (or separate-) phase saturation is presented for selected times (i.e., 20 and 70 years). Additionally, to better illustrate the CO_2 migration through time and space, a cross-sectional view of the CO_2 plume is presented as slices through the center of the injection wells and along

-3400

-3600

-10000

Mount Simor

-5000

the well traces. Figure 3 and Figure 4 show the CO₂-rich (or separate) phase saturation for selected times for slices A-A' and B-B', respectively.

The maximum pressure differential corresponds to the end of the injection period (year 20). After that time, the pressure slowly dissipates, resulting in the maximum pressure differential being below 30 psi at 70 years, and below 20 psi at 100 years. The pressure differential distribution has been presented instead of a defined pressure front because the calculated pressure head in the Mt. Simon is greater than the calculated pressure head in the lowermost underground source of drinking water (USDW), the St. Peter Sandstone, under initial conditions prior to injection. Figure 2 presents aqueous pressure differentials from baseline at the top of the injection zone and the extent of the carbon dioxide plume at 20 years after the start of injection (i.e., at site closure).

The model predicts that the areal extent of the CO_2 plume (defined as 99.0 percent of the separate-phase CO_2 mass) increases during injection and for 2 years post-injection and then begins to decrease as buoyancy forces dominate and plume migration is predominately upward. Figure 5 shows the cumulative area of the CO_2 mass plume with time. The maximum plume extent, 6.46 mi², occurs at 22 years after the start of injection (2 years after the cessation of injection).

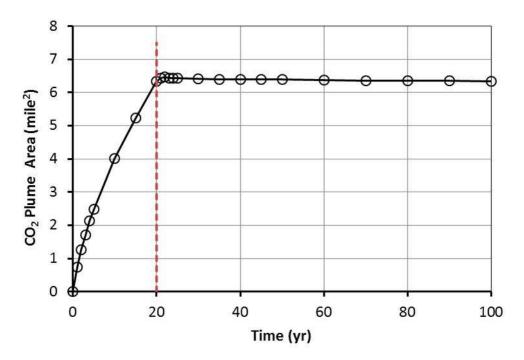


Figure 5. Simulated plume area over time (the vertical dashed line denotes the time CO₂ injection ceases).

The predicted extent of the CO_2 plume at the time of site closure, 50 years after the cessation of CO_2 injection, was determined from the computational model results.

Figure 6 shows the predicted areal extent of the CO_2 plume (defined as 99.0 percent of the separate-phase CO_2 mass) at the time of site closure. The simulation predictions show that 99.0 percent of the separate-phase CO_2 mass would be contained within an area of 6.35 mi² at the

time of site closure. This plume is only 1.7% smaller than the maximum plume area, which occurs at 22 years after the start of injection (Figure 5).

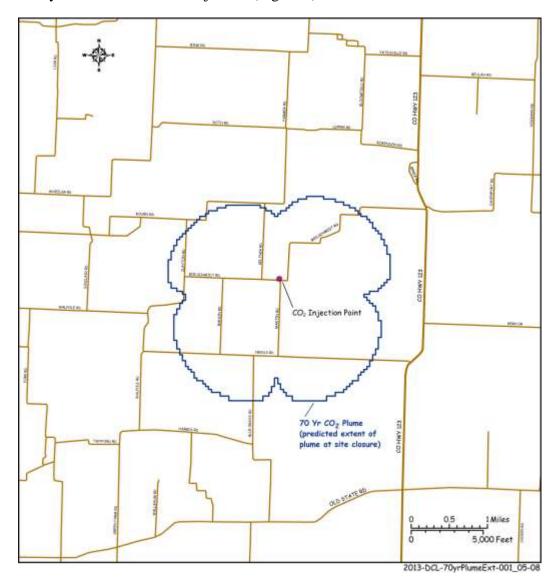


Figure 6. Simulated areal extent of the CO_2 plume at the time of site closure (70 years after CO_2 injection was initiated).

Post-Injection Monitoring Plan

FutureGen will perform post-injection monitoring, as required by 40 CFR 146.93(b), as described below.

Pressure monitoring of the injection zone will occur in four monitoring wells. The Testing and Monitoring Plan (Attachment C of this permit) describes the planned monitoring activities. In addition, FutureGen will conduct groundwater sampling in the shallow, semi-consolidated glacial sediments that make up the surficial aquifer.

Quality assurance and surveillance measures:

Data quality assurance and surveillance protocols adopted by the project are designed to facilitate compliance with the requirements specified in 40 CFR 146.90(k). Quality Assurance (QA) requirements for direct measurements within the injection zone, above the confining zone, and within the shallow USDW aquifer that are critical to the post-injection monitoring, program (e.g., pressure and aqueous concentration measurements) are described in the Quality Assurance and Surveillance Plan (QASP) that is presented in Appendix G of the Testing and Monitoring Plan. These measurements will be performed based on best industry practices and the QA protocols recommended by the geophysical services contractors selected to perform the work.

Location of Monitoring Wells

Monitoring well locations are described in the Testing and Monitoring Plan (Attachment C of this permit). Their coordinates are provided in Appendix A of this plan. The objective of the monitoring program is to select and implement a suite of monitoring technologies that are both technically robust and provide an effective means of 1) evaluating CO_2 mass balance, 2) detecting any unforeseen containment loss, and 3) evaluating pressure changes in the reservoir to ensure that monitored values corroborate modeled expectations.

As part of the project's design optimization, the monitoring well network has been configured (Figure 7) to effectively monitor and account for the injected CO₂ and pressure changes. The design includes a total of nine monitoring wells:

- Two Above Confining Zone (ACZ) wells. These wells will be used to monitor immediately above the Eau Claire caprock in the Ironton Sandstone. Monitored parameters include: pressure, temperature, and hydrogeochemical indicators of CO₂ (Table 6).
- Two Single-Level in-Reservoir (SLR) wells (one of which is a reconfiguration of the previously drilled stratigraphic well). These wells will be used to monitor within the injection zone beyond the east and west ends of the horizontal CO₂-injection laterals. Monitored parameters include: pressure, temperature, and hydrogeochemical indicators of CO₂ (Table 6). One additional SLR well (a tenth monitoring well) will be installed outside of the expected CO₂ plume to monitor pressure effects in the injection zone.
- Three Reservoir Access Tubes (RAT) wells. These are fully cased wells, which allow access for monitoring instrumentation in the reservoir via pulsed neutron capture (PNC)

logging equipment. To avoid two-phase flow near the borehole, which can distort the CO_2 saturation measurements, the wells will not be perforated. Monitoring parameters include: quantification of CO_2 saturation across the reservoir and caprock.

• One USDW well. This well will be used to monitor the lowermost USDW (the St. Peter Sandstone). Monitored parameters include: pressure, temperature, and hydrogeochemical indicators of CO₂ (Table 6).

FutureGen will also conduct sampling in the shallow, semi-consolidated glacial sediments that make up the surficial aquifer, using 9 local landowner wells and one well drilled for the project, to establish baseline conditions. The coordinates of these wells are provided in Appendix B of this plan.

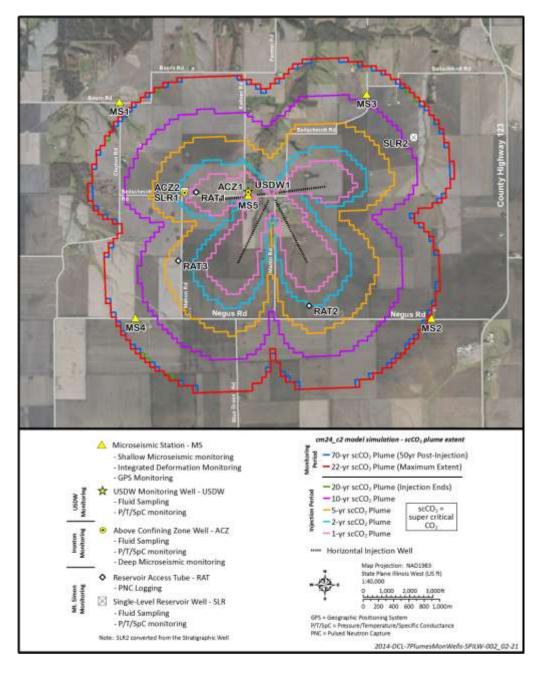


Figure 7. Map of monitoring well locations.

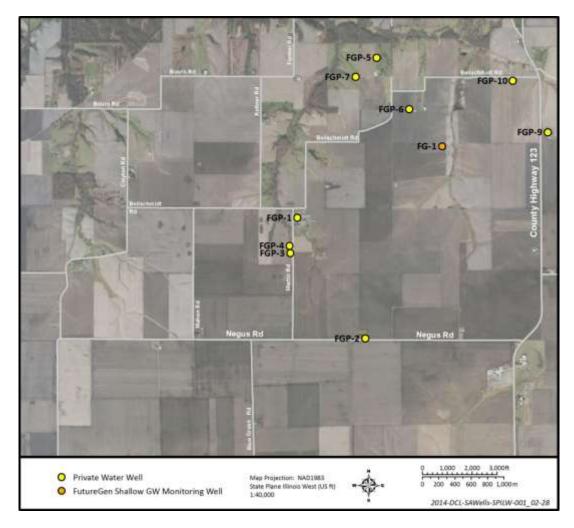


Figure 8. Surficial aquifer monitoring locations. Well FG-1 is a dedicated well drilled for the purposes of the FutureGen project, while wells FGP-1 through FGP-10 wells are local landowner wells.

Summary of Planned Post-Injection Monitoring Activities

The suite of indirect geophysical monitoring methods that will be used to monitor the areal extent, evolution, and fate and transport of the injected CO₂ plume during PISC include: PNC logging, passive seismic monitoring, integrated surface deformation monitoring, and time-lapse gravity surveys. Table 2 summarizes the testing and monitoring activities planned for the post-injection phase; collection and recording of continuous monitoring data will occur at the frequencies described in Table 13.

Table 2. Summary of post-injection monitoring activities.

Monitoring Category	Monitoring Method/Location	Frequency (Post-Injection Phase)
	Fluid sampling in surficial aquifers: 10 local landowner wells and 1 project-drilled well	None Planned
		Geochemistry Every 5 years
Groundwater Quality and Geochemistry Monitoring	Fluid sampling in St. Peter: one lowermost USDW well	Continuous temperature and pressure monitoring
		Geochemistry Every 5 years
	Fluid sampling in Ironton: two ACZ wells	Continuous temperature and pressure monitoring
	Fluid sampling in Mount Simon: SLR monitoring wells	Every 5 years
Injection Zone Monitoring	Pulsed-neutron capture (PNC) logging at 3 RAT wells	Every 5 years
	Pressure monitoring in Mount Simon: two SLR monitoring wells	Continuous
	Integrated deformation monitoring: five surface monitoring stations	Continuous
Indirect Geophysical Monitoring Techniques	Passive deep microseismic arrays in two ACZ wells and five seismometers in shallow cased bore holes.	Continuous
Note: For details and information	ation on continuous monitoring, see Table 13.	

Groundwater Quality Monitoring

FutureGen will conduct groundwater sampling every 5 years according to the procedures described below.

Specific information concerning the sampling methods, analytical techniques, laboratories and quality assurance for sampling for the post-injection monitoring program are presented in the FutureGen QASP; see Table A.2 for Monitoring Tasks, Methods, and Schedule.

Sampling will take place at the frequencies specified in Table 3 (for the surficial aquifers), Table 4 (for the St. Peter), and Table 5 (for the Ironton). Because near-surface environmental impacts are not expected, surficial aquifer (<100 ft bgs) monitoring will only be conducted for a sufficient duration to establish baseline conditions (minimum of three sampling events) during the injection phase of the project.

- Surficial aquifer monitoring is not planned during the post-injection phase; however, the
 need for additional surficial aquifer monitoring will be continually evaluated throughout
 the operational phases of the project, and may be reinstituted if conditions warrant or if
 requested by the EPA UIC Program Director.
- Target parameters for the ACZ wells include pressure, temperature, hydrogeochemical indicators of CO₂ (Table 6), and brine composition.
- Target parameters for the USDW and surficial aquifer wells include pressure, temperature, hydrogeochemical indicators of CO₂ (Table 6), and brine composition.

If a leakage response is observed in the ACZ early-detection monitoring wells (Ironton) then the decision not to institute USDW aquifer triggers will be reevaluated based on the magnitude of the observed leakage response and predictive simulations of CO₂ transport between the Ironton and the St. Peter Formations.

Table 3. Sampling schedule for surficial aquifer monitoring wells.

Monitoring well name/location/map reference: Surficial aquifer monitoring wells Well depth/formation(s) sampled: Shallow glacial sediments (approx. 17 ft – 49 ft)		
Parameter/Analyte	Frequency (Post-Injection Phase)	
Dissolved or separate-phase CO ₂	None Planned	
Pressure	None Planned	
Temperature	None Planned	
Other parameters, including total dissolved solids, pH, specific conductivity, major cations and anions, trace metals, dissolved inorganic carbon, total organic carbon, carbon and water isotopes, and radon	None Planned	

Table 4. Sampling schedule for the USDW monitoring well.

Monitoring well name/location/map reference: One USDW monitoring well (see Figure 7) Well depth/formation(s) sampled: St. Peter Sandstone (2,000 ft) Frequency				
Parameter/Analyte	(Post-Injection Phase)			
Dissolved or separate-phase CO ₂	Every 5 years			
Pressure	Continuous			
Temperature	Continuous			
Other parameters, including total dissolved solids, pH, specific conductivity, major cations and anions, trace metals, dissolved inorganic carbon, total organic carbon, carbon and water isotopes, and radon	Every 5 years			
Note: For details and information on continuous monitoring, see Table 13.				

Table 5. Sampling schedule for ACZ monitoring wells.

Monitoring well name/location/map reference: Two ACZ monitoring wells (see Figure 7) Well depth/formation(s) sampled: Ironton Sandstone (3,470 ft)		
Parameter/Analyte	Frequency (Post-Injection Phase)	
Dissolved or separate-phase CO ₂	Every 5 years	
Pressure	Continuous	
Temperature	Continuous	
Other parameters, including total dissolved solids, pH, specific conductivity, major cations and anions, trace metals, dissolved inorganic carbon, total organic carbon, carbon and water isotopes, and radon	Every 5 years	
Note: For details and information on continuous monitoring, see Table 13.		

Note: collection and recording of continuous monitoring data will occur at the frequencies described in Table 13.

Sampling methods:

Sampling procedures are discussed below, and specific details are provided in the FutureGen QASP Table A.2.

During all groundwater sampling, field parameters (pH, specific conductance, and temperature) will be monitored for stability and used as an indicator of adequate well purging (i.e., parameter stabilization provides indication that a representative sample has been obtained). Calibration of field probes will follow the manufacturer's instructions using standard calibration solutions. A comprehensive list of target analytes and groundwater sample collection requirements is provided in Table 6. All analyses will be performed in accordance with the analytical requirements listed in Table 7. Additional analytes may be included for the shallow USDW based on landowner requests (e.g., coliform bacteria).

Sampling and analytical techniques for target parameters are given in Table 6 and Table 7, respectively.

Table 6. Aqueous sampling requirements for target parameters.

Parameter	Volume/Container	Preservation	Holding Time
Major Cations: Al, Ba, Ca, Fe, K, Mg, Mn, Na, Si,	20-mL plastic vial	Filtered (0.45 μm), HNO ₃ to pH <2	60 days
Trace Metals: Sb, As, Cd, Cr, Cu, Pb, Se, Tl	20-mL plastic vial	Filtered (0.45 μm), HNO ₃ to pH <2	60 days
Cyanide (CN-)	250-mL plastic vial	NaOH to pH > 12, 0.6g ascorbic acid Cool 4°C,	14 days
Mercury	250-mL plastic vial	Filtered (0.45 μm), HNO ₃ to pH <2	28 days
Anions: Cl ⁻ , Br ⁻ , F ⁻ , SO ₄ ²⁻ , NO ₃ ⁻	125-mL plastic vial	Filtered (0.45 μm), Cool 4°C	45 days
Total and Bicarbonate Alkalinity (as CaCO ₃ ²)	100-mL HDPE	Filtered (0.45 μm), Cool 4°C	14 days
Gravimetric Total Dissolved Solids (TDS)	250-mL plastic vial	Filtered (0.45 μm), no preservation, Cool 4°C	7 days
Water Density	100-mL plastic vial	No preservation, Cool 4°C	
Total Inorganic Carbon (TIC)	250-mL plastic vial	H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Dissolved Inorganic Carbon (DIC)	250-mL plastic vial	Filtered (0.45 μ m), H_2SO_4 to pH <2, Cool 4°C	28 days
Total Organic Carbon (TOC)	250-mL amber glass	Unfiltered, H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Dissolved Organic Carbon (DOC)	125-mL plastic vial	Filtered (0.45 μ m), H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Volatile Organic Analysis (VOA)	Bottle set 1: 3-40-mL sterile clear glass vials Bottle set 2: 3-40-mL sterile amber glass vials	Zero headspace, Cool <6 °C, Clear glass vials will be UV-irradiated for additional sterilization	7 days
Methane	Bottle set 1: 3-40-mL sterile clear glass vials Bottle set 2: 3-40-mL sterile amber glass vials	Zero headspace, Cool <6 °C, Clear glass vials (bottle set 1) will be UV- irradiated for additional sterilization	7 days
Stable Carbon Isotopes $^{13/12}$ C $(\delta^{13}$ C) of DIC in Water	60-mL plastic or glass	Filtered (0.45-μm), Cool 4°C	14 days
Radiocarbon ¹⁴ C of DIC in Water	60-mL plastic or glass	Filtered (0.45-μm), Cool 4°C	14 days
Hydrogen and Oxygen Isotopes $^{2/1}$ H (δ D) and $^{18/16}$ O (δ ¹⁸ O) of Water	60-mL plastic or glass	Filtered (0.45-μm), Cool 4°C	45 days

Parameter	Volume/Container	Preservation	Holding Time
Carbon and Hydrogen Isotopes (¹⁴ C, ^{13/12} C, ^{2/1} H) of Dissolved Methane in Water	1-L dissolved gas bottle or flask	Benzalkonium chloride capsule, Cool 4°C	90 days
Compositional Analysis of Dissolved Gas in Water (including N_2 , CO_2 , O_2 , A_7 , H_2 , H_2 , CO_4 , CO_5 , CO_5 , CO_6 , CO_7	1-L dissolved gas bottle or flask	Benzalkonium chloride capsule, Cool 4°C	90 days
Radon (²²² Rn)	1.25-L PETE	Pre-concentrate into 20-mL scintillation cocktail. Maintain groundwater temperature prior to pre-concentration	1 day
рН	Field parameter	None	<1 h
Specific Conductance	Field parameter	None	<1 h
HDPE = high-density polyethylen	e; PETE = polyethylene to	erephthalate	

Table 7. Analytical requirements.

Table 7. Analytical requirements.				
Parameter	Analysis Method	Detection Limit or Range	Typical Precision/ Accuracy	QC Requirements
Major Cations: Al, Ba, Ca, Fe, K, Mg, Mn, Na, Si,	ICP-AES, EPA Method 6010B or similar	1 to 80 µg/L (analyte dependent)	±10%	Daily calibration; blanks, LCS, and duplicates and matrix spikes at 10% level per batch of 20
Trace Metals: Sb, As, Cd, Cr, Cu, Pb, Se, Tl	ICP-MS, EPA Method 6020 or similar	0.1 to 2 µg/L (analyte dependent)	±10%	Daily calibration; blanks, LCS, and duplicates and matrix spikes at 10% level per batch of 20
Cyanide (CN-)	SW846 9012A/B	5 μg/L	±10%	Daily calibration; blanks, LCS, and duplicates at 10% level per batch of 20
Mercury	CVAA SW846 7470A	0.2 μg/L	±20%	Daily calibration; blanks, LCS, and duplicates and matrix spikes at 10% level per batch of 20
Anions: Cl ⁻ , Br ⁻ , F ⁻ , SO ₄ ²⁻ , NO ₃ ⁻	Ion Chromatography, EPA Method 300.0A or similar	33 to 133 µg/L (analyte dependent)	±10%	Daily calibration; blanks, LCS, and duplicates at 10% level per batch of 20
Total and Bicarbonate Alkalinity (as CaCO ₃ ²⁻)	Titration, Standard Methods 2320B	1 mg/L	±10%	Daily calibration; blanks, LCS, and duplicates at 10% level per batch of 20
Gravimetric Total Dissolved Solids (TDS	Gravimetric Method Standard Methods 2540C	10 mg/L	±10%	Balance calibration, duplicate samples
Water Density	ASTM D5057	0.01 g/mL	±10%	Balance calibration, duplicate samples
Total Inorganic Carbon (TIC)	SW846 9060A or equivalent Carbon analyzer, phosphoric acid digestion of TIC	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Dissolved Inorganic Carbon (DIC)	SW846 9060A or equivalent Carbon analyzer, phosphoric acid digestion of DIC	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Total Organic Carbon (TOC)	SW846 9060A or equivalent Total organic carbon is converted to carbon dioxide by chemical oxidation of the organic carbon in the sample. The carbon dioxide is measured using a non-dispersive infrared detector.	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Dissolved Organic Carbon (DOC)	SW846 9060A or equivalent Total organic carbon is converted to carbon dioxide by chemical oxidation of the organic carbon in the sample. The carbon dioxide is measured using a non-dispersive infrared detector.	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Volatile Organic Analysis (VOA)	SW846 8260B or equivalent Purge and Trap GC/MS	0.3 to 15 µg/L	±20%	Blanks, LCS, spike, spike duplicates per batch of 20
Methane	RSK 175 Mod Headspace GC/FID	10 μg/L	±20%	Blanks, LCS, spike, spike duplicates per batch of 20
Stable Carbon Isotopes ^{13/12} C (1 ¹³ C) of DIC in Water	Gas Bench for ^{13/12} C	50 ppm of DIC	±0.2p	Duplicates and working standards at 10%

Parameter	Analysis Method	Detection Limit or Range	Typical Precision/ Accuracy	QC Requirements
Radiocarbon ¹⁴ C of DIC in Water	AMS for ¹⁴ C	Range: 0 i 200 pMC	±0.5 pMC	Duplicates and working standards at 10%
Hydrogen and Oxygen Isotopes $^{2/1}$ H (δ) and $^{18/16}$ O (1^{18} O) of Water	CRDS H ₂ O Laser	Range: - 500% to 200% vs. VSMOW	^{2/1} H: ±2.0‰ ^{18/16} O: ±0.3‰	Duplicates and working standards at 10%
Carbon and Hydrogen Isotopes (¹⁴ C, ^{13/12} C, ^{2/1} H) of Dissolved Methane in Water	Offline Prep & Dual Inlet IRMS for ¹³ C; AMS for ¹⁴ C	¹⁴ C Range: 0 & DupMC	14C: ±0.5pMC 13C: ±0.2‰ 2/1H: ±4.0‰	Duplicates and working standards at 10%
Compositional Analysis of Dissolved Gas in Water (including N_2 , CO_2 , O_2 , Ar , H_2 , He , CH_4 , C_2H_6 , C_3H_8 , iC_4H_{10} , nC_4H_{10} , iC_5H_{12} , nC_5H_{12} , and C_6+)	Modified ASTM 1945D	1 to 100 ppm (analyte dependent)	Varies by compon-ent	Duplicates and working standards at 10%
Radon (²²² Rn)	Liquid scintillation after pre- concentration	5 mBq/L	±10%	Triplicate analyses
рН	pH electrode	2 to 12 pH units	±0.2 pH unit For indication only	User calibrate, follow manufacturer recommendations
Specific Conductance	Electrode	0 to 100 mS/cm	±1% of reading For indication only	User calibrate, follow manufacturer recommendations

 $ICP-AES = inductively \ coupled \ plasma \ atomic \ emission \ spectrometry; \ ICP-MS = inductively \ coupled \ plasma \ mass \ spectrometry; \ LCS = laboratory \ control \ sample; \ GC/MS = gas \ chromatography-mass \ spectrometry; \ GC/FID = gas \ chromatography \ with \ flame \ ionization \ detector; \ AMS = accelerator \ mass \ spectrometry; \ CRDS = cavity \ ring \ down \ spectrometry; \ IRMS = isotope \ ratio \ mass \ spectrometry; \ LC-MS = liquid \ chromatography-mass \ spectrometry; \ ECD = electron \ capture \ detector$

Laboratory to be used/chain-of-custody procedures:

Samples will be tracked using appropriately formatted chain-of-custody forms. The sample handling and chain of custody of water, formation fluids, and pipeline fluid as well as environmental gas or air samples will conform to EPA guidance, and be conducted as discussed in Sections B.1.3 and B.1.5 thru B.1.7 of the FutureGen QASP (Appendix G of the Testing and Monitoring Plan).

Plan for guaranteeing access to all monitoring locations:

The land on which the ACZ and USDW wells are located will either be purchased or leased for the life of the project, so access will be secured.

Access to the surficial aquifer wells will not be required over the lifetime of the project. Access to wells for baseline sampling has been on a voluntary basis by the well owner. Nine local landowners agreed to have their surficial aquifer wells sampled although sampling is not anticipated in surficial wells during the PISC period.

Carbon Dioxide Plume and Pressure-Front Tracking

Direct Pressure Monitoring:

FutureGen will conduct direct pressure-front monitoring to meet the requirements of 40 CFR 146.93(b). Continuous monitoring of injection zone pressure and temperature (P/T) will be performed with sensors installed in wells that are completed in the injection zone. P/T monitoring in the monitoring wells will be performed using a real-time monitoring system with surface readout capabilities so that pressure gauges do not have to be removed from the well to retrieve data.

The following measures will be taken to ensure that the pressure gauges are providing accurate information on an ongoing basis:

- High-quality (high-accuracy, high-resolution) gauges with low drift characteristics will be used.
- Gauge components (gauge, cable head, cable) will be manufactured of materials designed to provide a long life expectancy for the anticipated downhole conditions.
- Upon acquisition, a calibration certificate will be obtained for every pressure gauge. The calibration certificate will provide the manufacturer's specifications for range, accuracy (% full scale), resolution (% full scale), drift (< psi per year), and calibration results for each parameter. The calibration certificate will also provide the date that the gauge was calibrated and the methods and standards used.
- Gauges will be installed above any packers so they can be removed if necessary for recalibration by removing the tubing string. Redundant gauges may be run on the same cable to provide confirmation of downhole pressure and temperature. Pressure gauges will be calibrated on an annual basis with current annual calibration certificates provided with test results to the EPA. In lieu of removing the injection tubing, the calibration of downhole pressure gauges will demonstrate accuracy by using a second pressure gauge, with current certified calibration, that will be lowered into the well to the same depth as the permanent downhole gauge. Calibration curves, based on annual calibration checks (using the second calibrated pressure gauge) developed for the downhole gauge, can be used for the purpose of the fall-off test. If used, these calibration curves (showing all historic pressure deviations) will accompany the fall-off test data submitted to the EPA.

- Upon installation, all gauges will be tested to verify they are functioning (reading/transmitting) correctly.
- Gauges will be pulled and recalibrated whenever a workover occurs that involves removal of tubing. A new calibration certificate will be obtained whenever a gauge is recalibrated.

Direct pressure monitoring in the injection zone will take place as indicated in Table 8. Collection and recording of continuous monitoring data will occur at the frequencies described in Table 13.

Table 8. Monitoring schedule for direct pressure-front tracking.

Well Location/Map Reference	Depth(s)/Formation(s)	Frequency (Post-Injection Phase)		
Two SLR monitoring wells (SLR Wells 1 and 2, see Figure 7)	Mount Simon/4,150 ft.	Continuous		
Note: For details and information on continuous monitoring, see Table 13.				

Direct Geochemical Plume Monitoring:

FutureGen will conduct direct CO₂ plume monitoring to meet the requirements of 40 CFR 146.93(b). Target parameters include pressure, temperature, and hydrogeochemical indicators of CO₂ (Table 6) and brine composition.

In addition to direct plume sampling and characterization, indirect montoring of the CO₂ plume will be conducted by continuing the periodic PNC logging across the injection zone and primary confining zone. PNC logging is a proven method for quantifying CO₂ saturation around a borehole. The PNC logging will be conducted using the three RAT wells. The RAT wells will be logged every 5 years during the post-injection period. Information collected will be compared with prior logs to determine trends.

Direct fluid sampling in the injection zone will take place as indicated in

Table 9 (collection and recording of continuous monitoring data will occur at the frequencies described in Table 13).

Table 9. Monitoring schedule for direct geochemical plume monitoring.

Monitoring well name/location/map reference: Two SLR monitoring wells (see Figure 7) Well depth/formation(s) sampled: Mount Simon Sandstone (4,150 ft)		
Parameter/Analyte	Frequency (Post-Injection Phase)	
Dissolved or separate-phase CO ₂	Every 5 years	
Pressure	Continuous	
Temperature	Continuous	
Other parameters, including major cations and anions, selected metals, general water-quality parameters (pH, alkalinity, total dissolved solids, specific gravity), and any tracers added to the ${\rm CO_2}$ stream	Every 5 years	
Note: For details and information on continuous monitoring, see Table 13	3.	

Sampling methods:

The FutureGen QASP and Testing and Monitoring Plan provide supplemental details about the sampling and analysis protocols for the direct fluid sampling that are outlined below.

Fluid samples will be collected from the monitoring wells completed in the injection zone as detailed in Table 9 above. Fluid samples will be collected using an appropriate method to preserve the fluid sample at injection zone temperature and pressure conditions. Examples of appropriate methods include using a bomb-type sampler (e.g., Kuster sampler) after pumped or swabbed purging of the sampling interval, using a Westbay sampler, or using a pressurized U-tube sampler (Freifeld et al. 2005). These types of pressurized sampling methods are needed to collect the two-phase fluids (i.e., aqueous and scCO₂ solutions) for measurement of the percent of water and CO₂ present at the monitoring location.

Fluid samples will be analyzed for parameters that are indicators of CO₂ dissolution, including major cations and anions, selected metals, general water-quality parameters (pH, alkalinity, TDS, specific gravity), and any tracers added to the CO₂ stream. Changes in major ion and trace element geochemistry are expected in the injection zone, but the arrival of proposed fluorocarbon or sulfonate tracers (co-injected with the CO₂) should provide an improved early-detection capability, because these compounds can be detected at 3 to 5 orders of magnitude lower relative concentration. Analysis of carbon and oxygen isotopes in injection zone fluids and the injection stream (^{13/12}C, ^{18/16}O) provides another potential supplemental measure of CO₂ migration. Where stable isotopes are included as an analyte, data quality and detectability will be reviewed throughout the active injection phase, and upon the UIC Program Director's approval, will be discontinued if these analyses provide limited benefit. Sampling and analytical techniques for target parameters are listed in Table 10 and Table 11, respectively.

<u>Laboratory to be used/chain-of-custody procedures:</u>

See FutureGen QASP Sections B.4.3 thru B.4.7.

Table 10. Aqueous sampling requirements for target parameters.

Parameter	Volume/Container	Preservation	Holding Time
Major Cations: Al, Ba, Ca, Fe, K, Mg, Mn, Na, Si,	20-mL plastic vial	Filtered (0.45 μm), HNO ₃ to pH <2	60 days
Trace Metals: Sb, As, Cd, Cr, Cu, Pb, Se, Tl	20-mL plastic vial	Filtered (0.45 μm), HNO ₃ to pH <2	60 days
Cyanide (CN-)	250-mL plastic vial	NaOH to pH > 12, 0.6g ascorbic acid Cool 4°C,	14 days
Mercury	250-mL plastic vial	Filtered (0.45 μm), HNO ₃ to pH <2	28 days
Anions: Cl ⁻ , Br ⁻ , F ⁻ , SO ₄ ²⁻ , NO ₃ ⁻	125-mL plastic vial	Filtered (0.45 μm), Cool 4°C	45 days
Total and Bicarbonate Alkalinity (as CaCO ₃ ²⁻)	100-mL HDPE	Filtered (0.45 μm), Cool 4°C	14 days
Gravimetric Total Dissolved Solids (TDS)	250-mL plastic vial	Filtered (0.45 μm), no preservation, Cool 4°C	7 days
Water Density	100-mL plastic vial	No preservation, Cool 4°C	
Total Inorganic Carbon (TIC)	250-mL plastic vial	H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Dissolved Inorganic Carbon (DIC)	250-mL plastic vial	Filtered (0.45 μ m), H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Total Organic Carbon (TOC)	250-mL amber glass	Unfiltered, H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Dissolved Organic Carbon (DOC)	125-mL plastic vial	Filtered (0.45 μ m), H ₂ SO ₄ to pH <2, Cool 4°C	28 days
Volatile Organic Analysis (VOA)	Bottle set 1: 3-40-mL sterile clear glass vials Bottle set 2: 3-40-mL sterile amber glass	Zero headspace, Cool <6 °C, Clear glass vials will be UV-irradiated for additional sterilization	7 days
	vials		
Methane	Bottle set 1: 3-40-mL sterile clear glass vials Bottle set 2: 3-40-mL sterile amber glass vials	Zero headspace, Cool <6 °C, Clear glass vials (bottle set 1) will be UV- irradiated for additional sterilization	7 days
Stable Carbon Isotopes $^{13/12}$ C $(\delta^{13}$ C) of DIC in Water	60-mL plastic or glass	Filtered (0.45-μm), Cool 4°C	14 days
Radiocarbon ¹⁴ C of DIC in Water	60-mL plastic or glass	Filtered (0.45-μm), Cool 4°C	14 days
Hydrogen and Oxygen Isotopes ^{2/1} H (δD) and	60-mL plastic or glass	Filtered (0.45-μm), Cool 4°C	45 days

Parameter	Volume/Container	Preservation	Holding Time	
$^{18/16}$ O (δ^{18} O) of Water				
Carbon and Hydrogen Isotopes (¹⁴ C, ^{13/12} C, ^{2/1} H) of Dissolved Methane in Water	1-L dissolved gas bottle or flask	Benzalkonium chloride capsule, Cool 4°C	90 days	
Compositional Analysis of Dissolved Gas in Water (including N ₂ , CO ₂ , O ₂ , Ar, H ₂ , He, CH ₄ , C ₂ H ₆ , C ₃ H ₈ , iC ₄ H ₁₀ , nC ₄ H ₁₀ , iC ₅ H ₁₂ , nC ₅ H ₁₂ , and C ₆ +)	1-L dissolved gas bottle or flask	Benzalkonium chloride capsule, Cool 4°C	90 days	
Radon (²²² Rn)	1.25-L PETE	Pre-concentrate into 20-mL scintillation cocktail. Maintain groundwater temperature prior to pre-concentration	1 day	
рН	Field parameter	None	<1 h	
Specific Conductance	Field parameter	None	<1 h	
HDPE = high-density polyethylene; PETE = polyethylene terephthalate				

Table 11. Analytical requirements.

	Table II. Analytica	ii requiremen	is.	
Parameter	Analysis Method	Detection Limit or Range	Typical Precision/ Accuracy	QC Requirements
Major Cations: Al, Ba, Ca, Fe, K, Mg, Mn, Na, Si,	ICP-AES, EPA Method 6010B or similar	1 to 80 µg/L (analyte dependent)	±10%	Daily calibration; blanks, LCS, and duplicates and matrix spikes at 10% level per batch of 20
Trace Metals: Sb, As, Cd, Cr, Cu, Pb, Se, Tl	ICP-MS, EPA Method 6020 or similar	0.1 to 2 µg/L (analyte dependent)	±10%	Daily calibration; blanks, LCS, and duplicates and matrix spikes at 10% level per batch of 20
Cyanide (CN-)	SW846 9012A/B	5 μg/L	±10%	Daily calibration; blanks, LCS, and duplicates at 10% level per batch of 20
Mercury	CVAA SW846 7470A	0.2 μg/L	±20%	Daily calibration; blanks, LCS, and duplicates and matrix spikes at 10% level per batch of 20
Anions: Cl ⁻ , Br ⁻ , F ⁻ , SO ₄ ²⁻ , NO ₃ ⁻	Ion Chromatography, EPA Method 300.0A or similar	33 to 133 µg/L (analyte dependent)	±10%	Daily calibration; blanks, LCS, and duplicates at 10% level per batch of 20
Total and Bicarbonate Alkalinity (as CaCO ₃ ²⁻)	Titration, Standard Methods 2320B	1 mg/L	±10%	Daily calibration; blanks, LCS, and duplicates at 10% level per batch of 20
Gravimetric Total Dissolved Solids (TDS	Gravimetric Method Standard Methods 2540C	10 mg/L	±10%	Balance calibration, duplicate samples
Water Density	ASTM D5057	0.01 g/mL	±10%	Balance calibration, duplicate samples
Total Inorganic Carbon (TIC)	SW846 9060A or equivalent Carbon analyzer, phosphoric acid digestion of TIC	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Dissolved Inorganic Carbon (DIC)	SW846 9060A or equivalent Carbon analyzer, phosphoric acid digestion of DIC	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Total Organic Carbon (TOC)	SW846 9060A or equivalent Total organic carbon is converted to carbon dioxide by chemical oxidation of the organic carbon in the sample. The carbon dioxide is measured using a non-dispersive infrared detector.	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Dissolved Organic Carbon (DOC)	SW846 9060A or equivalent Total organic carbon is converted to carbon dioxide by chemical oxidation of the organic carbon in the sample. The carbon dioxide is measured using a non-dispersive infrared detector.	0.2 mg/L	±20%	Quadruplicate analyses, daily calibration
Volatile Organic Analysis (VOA)	SW846 8260B or equivalent Purge and Trap GC/MS	0.3 to $15~\mu g/L$	±20%	Blanks, LCS, spike, spike duplicates per batch of 20
Methane	RSK 175 Mod Headspace GC/FID	10 μg/L	±20%	Blanks, LCS, spike, spike duplicates per batch of 20
Stable Carbon Isotopes ^{13/12} C (1 ¹³ C) of DIC in Water	Gas Bench for ^{13/12} C	50 ppm of DIC	±0.2p	Duplicates and working standards at 10%

Parameter	Analysis Method	Detection Limit or Range	Typical Precision/ Accuracy	QC Requirements
Radiocarbon ¹⁴ C of DIC in Water	AMS for ¹⁴ C	Range: 0 i 200 pMC	±0.5 pMC	Duplicates and working standards at 10%
Hydrogen and Oxygen Isotopes $^{2/1}$ H (δ) and $^{18/16}$ O (1^{18} O) of Water	CRDS H ₂ O Laser	Range: - 500‰ to 200‰ vs. VSMOW	^{2/1} H: ±2.0‰ ^{18/16} O: ±0.3‰	Duplicates and working standards at 10%
Carbon and Hydrogen Isotopes (¹⁴ C, ^{13/12} C, ^{2/1} H) of Dissolved Methane in Water	Offline Prep & Dual Inlet IRMS for ¹³ C; AMS for ¹⁴ C	¹⁴ C Range: 0 & DupMC	¹⁴ C: ±0.5pMC ¹³ C: ±0.2‰ ^{2/1} H: ±4.0‰	Duplicates and working standards at 10%
Compositional Analysis of Dissolved Gas in Water (including N ₂ , CO ₂ , O ₂ , Ar, H ₂ , He, CH ₄ , C ₂ H ₆ , C ₃ H ₈ , iC ₄ H ₁₀ , nC ₄ H ₁₀ , iC ₅ H ₁₂ , nC ₅ H ₁₂ , and C ₆ +)	Modified ASTM 1945D	1 to 100 ppm (analyte dependent)	Varies by compon-ent	Duplicates and working standards at 10%
Radon (²²² Rn)	Liquid scintillation after pre- concentration	5 mBq/L	±10%	Triplicate analyses
pН	pH electrode	2 to 12 pH units	±0.2 pH unit For indication only	User calibrate, follow manufacturer recommendations
Specific Conductance	Electrode	0 to 100 mS/cm	±1% of reading For indication only	User calibrate, follow manufacturer recommendations

 $ICP-AES = inductively \ coupled \ plasma \ atomic \ emission \ spectrometry; \ ICP-MS = inductively \ coupled \ plasma \ mass \ spectrometry; \ LCS = laboratory \ control \ sample; \ GC/MS = gas \ chromatography-mass \ spectrometry; \ GC/FID = gas \ chromatography \ with \ flame \ ionization \ detector; \ AMS = accelerator \ mass \ spectrometry; \ CRDS = cavity \ ring \ down \ spectrometry; \ IRMS = isotope \ ratio \ mass \ spectrometry; \ LC-MS = liquid \ chromatography-mass \ spectrometry; \ ECD = electron \ capture \ detector$

Indirect Carbon Dioxide Plume and Pressure-Front Tracking

FutureGen will track the CO₂ plume and pressure front to meet the requirements of 40 CFR 146.93(b) using integrated deformation monitoring and passive seismic monitoring.

The frequency of indirect plume and pressure-front monitoring activities during the post-injection phase, is given in Table 12 (collection and recording of continuous monitoring data will occur at the frequencies described in Table 13). The coordinates of the monitoring wells/stations are provided in Appendix C of this Plan.

Monitoring Technique	Location	Frequency (Post-Injection Phase)
Integrated deformation monitoring	5 locations (see Figure 7)	Continuous
Passive seismic monitoring (microseismicity)	Surface measurements (see Figure 7) plus downhole sensor arrays at ACZ Wells 1 and 2	Continuous

Table 12. Monitoring schedule for indirect plume and pressure-front monitoring.

Integrated deformation monitoring

Integrated deformation monitoring integrates ground data from permanent Global Positioning System (GPS) stations, and tiltmeters, supplemented with annual Differential GPS (DGPS) surveys, and larger-scale Differential Interferometric Synthetic Aperture Radar (DInSAR) surveys to detect and map temporal ground-surface deformation. These data reflect the dynamic geomechanical behavior of the subsurface in response to CO₂ injection. These measurements will provide useful information about the evolution and symmetry of the pressure front. These results will be compared with model predictions throughout the operational phase of the project and significant deviation in observed response would result in further action, including a detailed evaluation of the observed response, calibration/refinement of the numerical model, and possible modification to the monitoring approach and/or storage site operations. Integrated deformation monitoring will take place at the locations shown in Figure 7.

Passive seismic monitoring (microseismicity)

The objective of the microseismic monitoring network (Figure 7; five stations and downhole arrays in the two ACZ wells) is to accurately determine the locations, magnitudes, and focal mechanisms of any potential injection-induced seismic events with the primary goals of 1) addressing public and stakeholder concerns related to induced seismicity, 2) estimating the spatial extent of the pressure front from the distribution of any potential seismic events, and 3) identifying features that may indicate areas of caprock failure and possible containment loss. The Emergency and Remedial Response Plan (Attachment F to this permit) provides additional information about seismic monitoring).

Table 13. Sampling and Recording Frequencies for Continuous Monitoring.

Well Condition	Minimum sampling frequency: once every	Minimum recording frequency: once every
For operating injection wells that are required to monitor continuously:	5 seconds	5 minutes ¹
For injection wells that are shut-in:	4 hours	4 hours

¹ This can be an average of the sampled readings over the previous 5-minute recording interval, or the maximum (or minimum, as appropriate) value identified over that recording interval

Notes

Sampling frequency refers to how often the monitoring device obtains data from the well for a particular parameter. For example, a recording device might sample a pressure transducer monitoring injection pressure once every two seconds and save this value in memory.

Recording frequency refers to how often the sampled information gets recorded to digital format (such as a computer hard drive). Following the same example above, the data from the injection pressure transducer might be recorded to a hard drive once every minute.

Proposed Schedule for Submitting Post-Injection Monitoring Results

During the PISC period, monitoring reports will be prepared and submitted to the EPA Region 5 UIC office annually. The reports will summarize methods and results of the groundwater-quality monitoring, CO₂ storage zone pressure tracking, and indirect geophysical monitoring for CO₂ plume tracking. See Table 14.

Table 14. Post-injection phase reporting schedule.

Planned Testing/Monitoring	Reporting Schedule
Groundwater Quality Monitoring Data	Annual
Carbon Dioxide Plume and Pressure-Front Tracking Data	Annual
Direct Pressure Monitoring Data	Annual
Indirect Carbon Dioxide Plume and Pressure- Front Tracking Data	Annual

The PISC and Site Closure Plan will be reviewed every 5 years during the PISC period (e.g., concurrent with or as a result of 5-year reevaluations of the AoR). Results of the plan review will be included in the PISC monitoring reports. Monitoring and operational results will be reviewed for adequacy in relation to the objectives of PISC monitoring. The monitoring locations,

methods, and schedule will be analyzed in relation to the size of the CO₂ storage zone, pressure front, and protection of USDWs. In case of changes to the PISC plan, a modified plan will be submitted to the EPA Region 5 UIC Branch Office for not less than 30 days prior to the planned intiation of the changes.

Alternative Post-Injection Site Care Time Frame

FutureGen is not requesting an alternative PISC time frame.

Non-Endangerment Demonstration Criteria

Prior to approval of the end of the PISC period, FutureGen will submit a demonstration of non-endangerment of USDWs to the UIC Program Director (40 CFR 146.93(b)(3)).

FutureGen will issue a report to the UIC Program Director. This report will make a demonstration of USDW non-endangerment based on the evaluation of the site monitoring data used in conjunction with the project's computational model. The report will include information detailing how the non-endangerment demonstration evaluation uses site-specific conditions to confirm and demonstrate non-endangerment. The report will include all relevant monitoring data and interpretations upon which the non-endangerment demonstration is based and any other information necessary for the UIC Program Director to replicate the analysis. The report will include the sections discussed below.

Summary of Existing Monitoring Data

A summary of all previous monitoring data at the site, including data collected during the injection and PISC phases of the project, will be submitted to help demonstrate non-endangerment. Data submittals will be in a format acceptable to the UIC Program Director (40 CFR 146.91(e)), and will include a narrative explanation of monitoring activities, including the dates of all monitoring events, changes to the monitoring program over time, and an explanation of all monitoring infrastructure that has existed at the site.

Comparison of Monitoring Data and Model Predictions and Model Documentation

The results of computational modeling used for AoR delineation will be compared to monitoring data collected during the operational and the PISC period. Monitoring data will also be compared with baseline data collected during site characterization, per 40 CFR 146.82(a)(6) and 146.87(d)(3). The data will include time-lapse temperature, pressure, ground water analysis, passive seismic, and geophysical surveys; i.e. logging, and 3D surface seismic surveys, used to update the computational model and to monitor the site. Data generated during the PISC period will be used to show that the computational model accurately represents the storage site and can be used as a proxy to determine the plume's properties and size. FutureGen will demonstrate this degree of accuracy by comparing the monitoring data obtained during the PISC period against the model's predicted properties (i.e., plume location, rate of movement, and pressure decay). Statistical methods will be employed to correlate the

data and confirm the model's ability to accurately represent the storage site. The validation of the computational model with the large volume of available data will be a significant element to support the non-endangerment demonstration. Further, the validation of the complete model over the areas, and at the points, where direct data collection has taken place will ensure confidence in the model for those areas where surface infrastructure preclude geophysical data collection and where there are no direct observation wells.

Evaluation of Carbon Dioxide Plume

FutureGen will use a combination of monitoring data, logs, geophysical surveys, and seismic methods to locate and track the movement of the CO₂ plume. Seismic surveys will be employed to determine the plume location at specific times. The data produced by these activities will be compared against the modeled predictions (see Figure 6) using statistical methods to validate the model's ability to accurately represent the storage site. Regarding the separate-phase carbon dioxide plume, the PISC monitoring data will show the stabilization of the CO₂ plume as the reservoir pressure returns to its near pre-injection state. For the separate-phase carbon dioxide plume, the risk to USDWs will decrease when the extent of pure-phase carbon dioxide ceases to grow either laterally or vertically. The stabilization of the plume combined with the lack of local penetrations of the confining formation will be significant factors in FutureGen's demonstration of non-endangerment. Furthermore, FutureGen's monitoring wells screened above the confining layer may be used to determine aqueous-phase concentrations of carbon dioxide and mobilized constituents in order to assess USDW endangerment. If a demonstration can be made, in conjunction with monitoring data, that a vast majority of the carbon dioxide has been immobilized via trapping mechanisms, this is strong evidence that the risk to USDWs posed by the carbon dioxide plume has decreased. Modeling may also be used to estimate future plume migration. Modeling results, including sensitivity analyses, may be used to demonstrate that plume migration rates are negligible based on available site characterization, monitoring, and operational data.

Evaluation of Mobilized Fluids

In addition to carbon dioxide, mobilized fluids may pose an ongoing risk to USDWs. These include native fluids that are high in TDS and therefore may impair a USDW, and fluids containing mobilized drinking water contaminants (e.g., arsenic, mercury, hydrogen sulfide). The geochemical data collected from monitoring wells will be used to demonstrate that no mobilized fluids have moved above the confining formation and, therefore after the PISC period, would not pose a risk to USDWs. Of particular importance are any monitoring wells that are screened above the primary confining zone, within any USDWs, and in the vicinity of any known leakage pathways. Monitoring data indicating steady or decreasing trends of potential drinking water contaminants below actionable levels (e.g., secondary and maximum contaminant levels) will be used for this demonstration. In order to demonstrate nonendangerment, FutureGen will compare the operational and PISC period samples of the lowermost USDW against the pre-injection baseline samples. This comparison will show that no significant changes have occurred in the fluid properties of the overlying formations. This will demonstrate that no mobilized formation fluids have moved through the confining

formation. This validation of confining zone integrity will demonstrate that the injectate and/or mobilized fluids would not represent an endangerment to any USDWs.

Evaluation of Reservoir Pressure

FutureGen will also demonstrate non-endangerment to USDWs by showing that during the PISC period, the pressure within the Mount Simon rapidly decreases to its near pre-injection static reservoir pressure. Because the increased pressure is the primary driving force for fluid movement that may endanger a USDW, the decay in the pressure differentials will provide strong justification that the injectate no longer poses a risk to any USDWs.

FutureGen will monitor the downhole reservoir pressure at various locations and intervals using a combination of surface and downhole pressure gauges. The measured pressure at a specific depth interval will be compared against the pressure predicted by the computational model (see Figures 1 and 2). Agreement between the actual and the predicted values will validate the accuracy of the model and further demonstrate non-endangerment.

Evaluation of Potential Conduits for Fluid Movement

Other than the project and monitoring wells, other distant potential conduits for fluid movement, or leakage pathways within the AoR are adequately constructed and/or plugged. Based on this information, the potential for fluid movement through artificial penetrations of the confining formation does not present a risk of endangerment to any USDWs.

Evaluation of Passive Seismic Data

Seismic monitoring will be used to further demonstrate confining formation integrity. FutureGen will provide seismic monitoring data showing that no seismic events have occurred that would indicate fracturing or fault activation near or through the confining formation. This validation of confining zone integrity will provide further support to demonstrate that the CO_2 plume is no longer an endangerment to any USDWs, by indicating that the response to the imposed fluid pressures due to injection are confined to the vicinity of the injection zone and below.

Site Closure Plan

FutureGen will conduct site closure activities to meet the requirements of 40 CFR 146.93(e). Site closure will occur at the end of the PISC period. Site closure activities will include decommissioning surface equipment, plugging monitoring wells, restoring the site, and preparing and submitting site closure reports.

The EPA Region 5 UIC Branch Office will be notified at least 120 days before site closure. In addition, state and local agencies including the Illinois State Geological Survey and Illinois Department of Natural Resources, as well as City of Jacksonville and Morgan County agencies will be notified prior to the scheduled site closure. At this time, there are no federally recognized Native American Tribes located within the AoR or the State of Illinois. If a federally recognized

Native American Tribe exists in the AoR or the State of Illinois at the time of site closure, it will be notified of site closure at that time.

A revised site closure plan will be submitted to the EPA Region 5 UIC Branch Office and state and local (and tribal) governmental agencies, if any changes have been made to the original site closure plan. After site closure is authorized, site closure field activities will be completed.

Planned Remedial/Site Restoration Activities

At the end of the PISC phase, FutureGen will ensure the site is reclaimed and returned to predevelopment condition to meet the requirements of 40 CFR 146.93(e).

Surface equipment decommissioning will occur in two phases: the first phase will occur after the active injection phase, and the second phase will occur at the end of PISC phase. The surface facilities at the storage site will include the Site Control Building and the WAPMMS (Well Annular Pressure Maintenance and Monitoring System) Building.

At the end of the active injection period, plume monitoring will continue, but there will be no further need for the pumping and control equipment. The Site Control Building will be demolished. All features will be removed except the WAPMMS Building, a 12-ft-wide access road with five parking spaces, a concrete sidewalk from the parking lot to the building, underground electrical and telephone services, and a chain-link fence surrounding the building. The common wall between the WAPMMS Building and the Site Control Building will be converted to an exterior wall. The injection wells will be plugged and capped below grade (see the Injection Well Plugging Plan in Attachment D of this permit). The gravel pad will be removed. The WAPMMS Building at the storage site will be repurposed to act as the collection node for data from the plume monitoring equipment. The building will contain equipment to receive real-time data from the monitoring wells and other monitoring stations and send the data via an internet connection to be analyzed offsite during the 50-year post-injection monitoring period.

All surface facilities will be removed at the end of the PISC phase. These facilities will include the WAPMMS Building, the access road with parking spaces, all sidewalks, underground electrical and telephone services, and fencing at the injection well sites. The site will be reclaimed and returned to predevelopment condition.

Soil will be backfilled around the monitoring and geophysical wells to bring the area around the wells back to pre-well-installation grade. Any remaining surface facilities associated with the monitoring well will be reclaimed and the area will be returned to predevelopment condition. All gravel pads, access roads, and surface facilities will be removed, and the land will be reclaimed for agricultural or other beneficial pre-construction uses.

Plugging the Monitoring Wells

Upon conclusion of the post-injection site care period (~50 years), all monitoring wells will be plugged and capped below grade in accordance with the approved monitoring well Plugging and Abandonment Plans (see Appendix E of this Plan). All deep monitoring wells at the site will be

plugged to prevent any upward migration of the CO₂ or formation fluids into USDWs. Each of the deep monitoring wells will be plugged and abandoned using best practices to prevent communication of fluids between the injection zone and USDWs. The deep monitoring wells in the injection interval have a direct connection between the injection formation and ground surface. The well-plugging program is designed to prevent communication between the injection zone and the USDWs.

Before the wells are plugged, the internal and external integrity of the wells will be confirmed by conducting cement-bond, temperature, and noise logs on each of the wells. In addition, a pressure fall-off test will be performed above the perforated intervals (where present) to confirm well integrity. The results of the logging and testing will be reviewed and approved by appropriate regulatory agencies prior to plugging the wells.

The wells with perforations (the SLR monitoring wells, the ACZ monitoring wells, and lowermost USDW monitoring well) will be plugged using a CO₂-resistant cement retainer method to cement the perforated intervals and a balanced plug method to cement the well above the perforated zones and the cement retainer. The RAT monitoring wells will not have perforations; therefore, only the balanced plug method will be used to plug these wells. Once the interior of the casing has been properly plugged with cement, the casing will be cut off below ground and capped. Regulations at the time of the plugging and abandonment will dictate the specifications regarding the depth at which the casing is cut and the method used to cap the well. The cap will be inscribed with the well identification number and the date of plug and abandonment.

Plugging the Geophysical Wells

The FutureGen microseismic and deformation monitoring designs include five geophysical monitoring stations. Two types of well completions will be constructed at each of the five geophysical monitoring stations: both well types will be completed as sealed access tubes designed to support downhole installation of either microseismic or tiltmeter instrumention in a subsurface moisture free environment. Well construction and plugging schematics showing the exposed formation intervals, casing diameters, casing depths, depths to USDWs, and the placement of all plugs are presented for each well type in Figure 9.

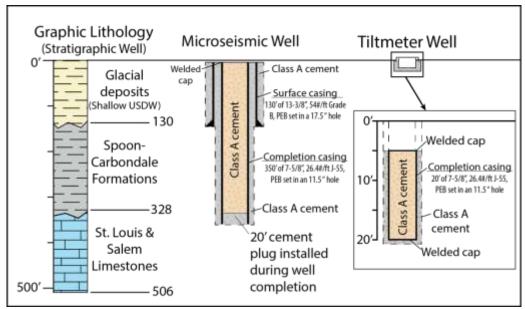


Figure 9. Diagram of Microseismic and Tiltmeter Wells After Plugging and Abandonment.

Upon conclusion of the post-injection site care period, all geophysical wells will be plugged and capped below grade in accordance with the approved monitoring well Plugging and Abandonment Plans (see Appendix E of this plan). All downhole instrumentation will be removed and each microseismic well casing and tiltmeter well casing will be plugged with cement to ensure that the well does not provide a conduit to the shallow USDW zone or ground surface. The procedures for plugging and abandoning both types of wells are very similar. However, cement volumes will differ depending upon the total depth of the well.

For both well-completion designs, class A cement will be used to plug the well casing. The geophysical wells will not have perforations; therefore, the balanced plug method will be used to plug these wells. Once the interior of the casing has been properly plugged with cement, the casing will be cut off below ground and capped. Regulations at the time of the plugging and abandonment will dictate the specifications regarding the depth at which the casing is cut and the method used to cap the well. The cap will be inscribed with the well identification number and the date of plug and abandonment.

The methods and materials described in this plan are based upon current understanding of the geology at the site and current well designs. If necessary, the plans will be updated to reflect the latest well designs. These new designs, materials, and methods will be described in the Notice of Intent to Plug submitted at least 60 days prior to the plugging of the wells.

After the completion of the plugging activities, a plugging report will be submitted to the UIC Program Director describing the methods used and tests performed on the well during plugging. This report will be submitted to the UIC Program Director within 60 days of completing the plugging activities.

Site Closure Reporting

A site closure report will be submitted to the EPA Region 5 UIC Branch Office and the previously notified state and local regulatory agencies within 90 days of site closure. The site closure report will include the following information:

- Documentation of appropriate well plugging, including a survey plat of the injection well location;
- Documentation of the well-plugging report to Illinois and local agencies that have authority over drilling activities at the facility site; and
- Records reflecting the nature, composition, and volume of the CO₂ injected in UIC wells.

In association with site closure, a record of notation on the facility property deed will be added to provide any potential purchaser of the property with the following information:

- Notification that the subsurface was used for CO₂ storage;
- The name of the Illinois and local agencies and the EPA Region 5 Branch Office to which the survey plat was submitted; and
- The volume of fluid injected, the injection zone, and the period over which injection occurred.

PISC and site closure records will be retained for 10 years after site closure. At the conclusion of the 10-year period, these records will be delivered to the EPA Region 5 UIC Branch Office for further storage.

APPENDIX A: Deep Monitoring Well Locations

Well ID	Well Type	Latitude (WGS84)	Longitude (WGS84)
ACZ1	Above Confining Zone 1	39.80034315	-90.07829648
ACZ2	Above Confining Zone 2	39.80029543	-90.08801028
USDW1	Underground Source of Drinking Water	39.80048042	-90.0782963
SLR1	Single-Level in-Reservoir 1	39.8004327	-90.08801013
SLR2	Single-Level in-Reservoir 2	39.80680878	-90.05298062
RAT1	Reservoir Access Tube 1	39.80035565	-90.08627478
RAT2	Reservoir Access Tube 2	39.78696855	-90.06902677
RAT3	Reservoir Access Tube 3	39.79229199	-90.08901656

APPENDIX B: Surficial Aquifer Monitoring Well Locations

Well ID	Well Type	Latitude	Longitude
FG-1	FutureGen Shallow Monitoring Well	39.80675	-90.05283
FGP-1	Private Well	39.79888	-90.0736
FGP-2	Private Well	39.78554	-90.0639
FGP-3	Private Well	39.79497	-90.0746
FGP-4	Private Well	39.79579	-90.0747
FGP-5	Private Well	39.81655	-90.0622
FGP-6	Private Well	39.81086	-90.057560
FGP-7	Private Well	39.81444	-90.065241
FGP-9	Private Well	39.80829	-90.0377
FGP-10	Private Well	39.81398	-90.0427

APPENDIX C: Microseismic Monitoring and Integrated Deformation Station Locations

Well ID/Station ID	Well/Station Type	Latitude (WGS84)	Longitude (WGS84)
MS1	Microseismic monitoring Station 1(shallow borehole)Integrated deformation monitoring station	39.8110768	-90.09797015
MS2	Microseismic monitoring Station 2 (shallow borehole)Integrated deformation monitoring station	39.78547402	-90.05028403
MS3	Microseismic monitoring Station 3 (shallow borehole)Integrated deformation monitoring station	39.81193502	-90.06016279
MS4	Microseismic monitoring Station 4 (shallow borehole)Integrated deformation monitoring station	39.78558513	-90.09557015
MS5	Microseismic monitoring Station 5 (shallow borehole)Integrated deformation monitoring station	39.80000524	-90.07830287
ACZ1	· Deep microseismic station (deep borehole)	39.80034315	-90.07829648
ACZ2	Deep microseismic station (deep borehole)	39.80029543	-90.08801028

APPENDIX D: Planned Construction Design and Plugging and Abandonment Plan Diagrams for Deep Monitoring Wells and Reservoir Access Tube Wells

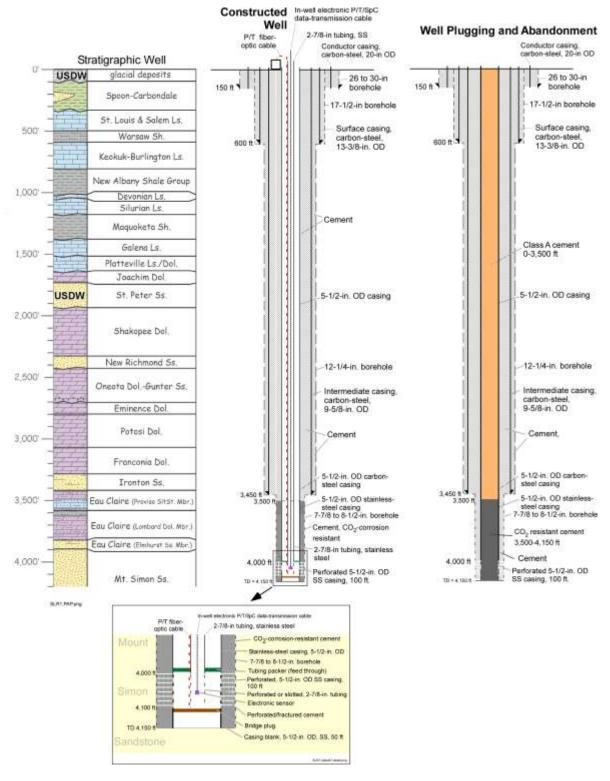


Figure D-1. Construction design and plugging and abandonment plan for new 5.5-in.-diameter single-level in-reservoir monitoring well.

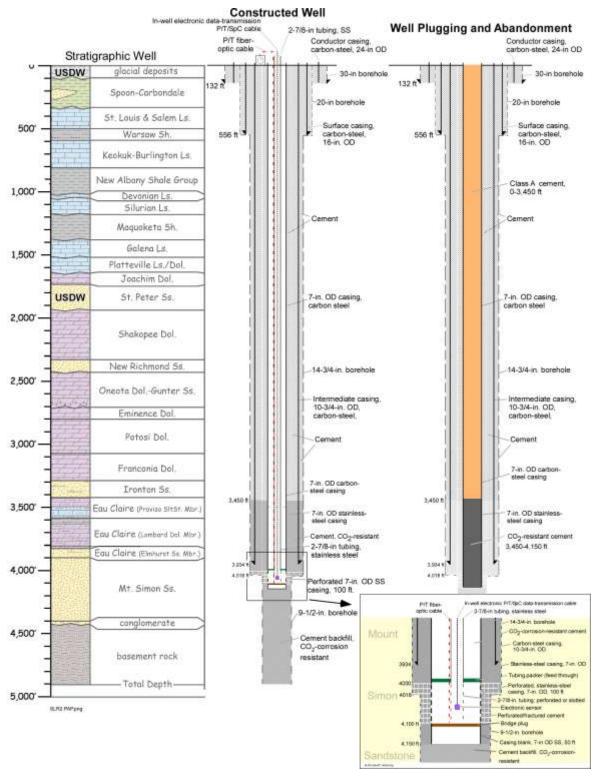


Figure D-2. Construction design and plugging and abandonment plan for 7-in.-diameter single-level inreservoir monitoring well to be reconfigured from the stratigraphic well.

Constructed Well

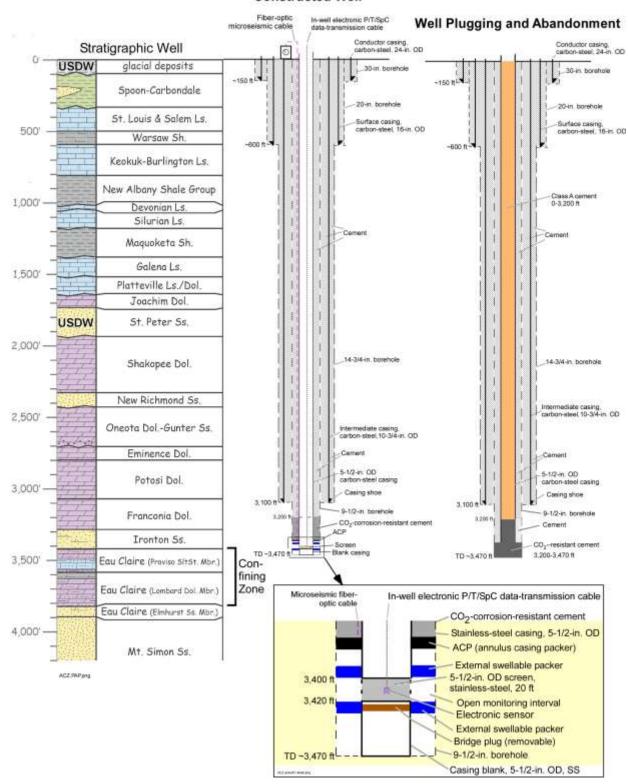


Figure D-3. Construction design and plugging and abandonment plan for the Above Confining Zone monitoring wells.

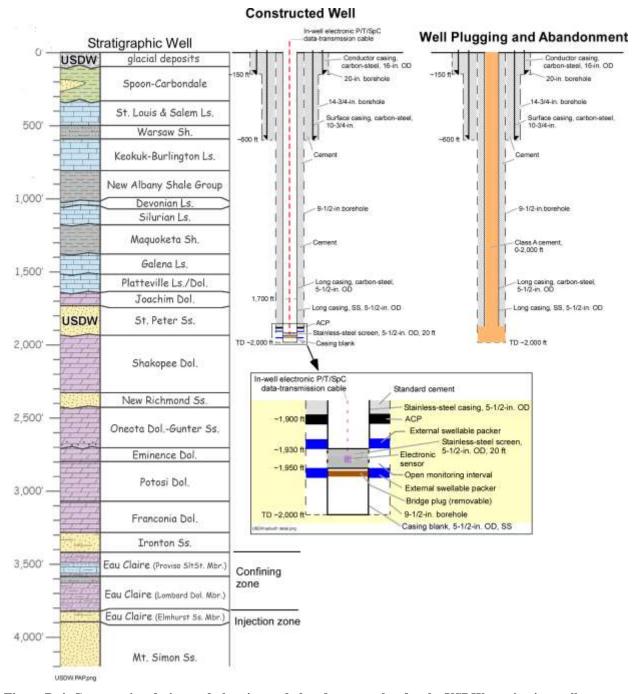


Figure D-4. Construction design and plugging and abandonment plan for the USDW monitoring well.

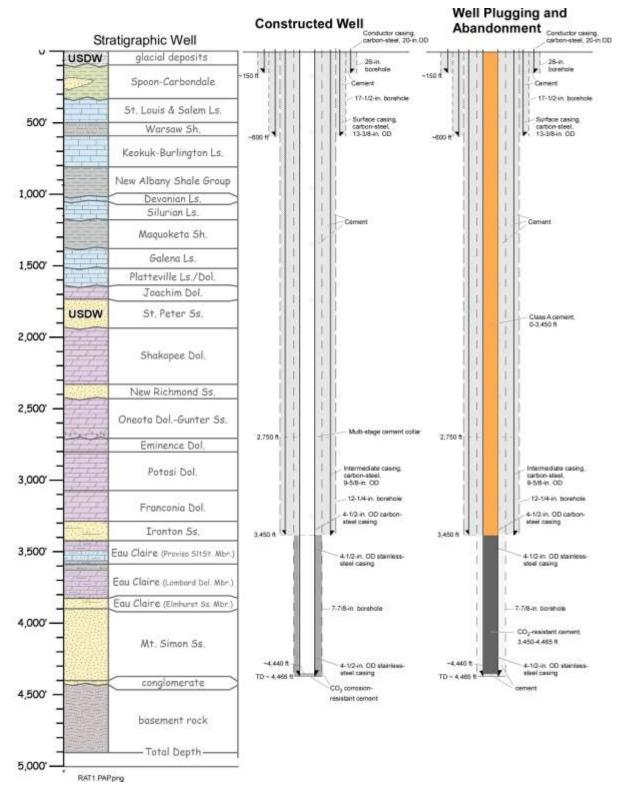


Figure D-5. Construction design and plugging and abandonment plan for the reservoir access tube wells.

APPENDIX E:Plugging and Abandonment Plans for Deep Monitoring Wells, Reservoir Access Tube Wells, and Geophysical Wells

Plugging and abandonment plans for the following monitoring wells are provided in this appendix:

Monitoring wells

- ACZ1
- ACZ2
- RAT1
- RAT2
- RAT3
- SLR1-5.5"
- SLR2-7"
- USDW1

Geophysical Wells

- MS1
- MS2
- MS3
- MS4
- MS5
- TM1
- TM2
- TM3
- TM4
- TM5

Post-Injection Site Care and Site Closure Plan for FutureGen Alliance Permit Number: IL-137-6A-0003 (Well #3)

				United	States E	nvironme	ntal Protect	_	MB No. 2040- Agency	0042 Ар	proval Expire	is 11/30/2014	
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24"	140	0-150		150			30"		gents .	e Dump Saile			
16"	8-4	0-600		600			20"		□ Th	e Two-Plug N	Nethod		
10-3/4	51	0.3,100		3,100			14.75"						
5-1/2"	17	0-3,470		3,470		- 7	9.5"		100	8377.			
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	oluma To Be Pi					68	20		418				
	ed Top of Plug					3,350	3.200		418				
-	d Top of Plug (if tagged ft.)				3,350	3,200		0				
	/t. (Lb/Gal.)					15.82	15.82		15.6				
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SIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN	WELL (FT)	HOLE SIZ	E I Th	e Balance M	sthod		
20"	94	0-150	150		26"	Th	e Dump Bail	er Method		
13-3/8		0-600	600		17.5™	Th	e Two-Plug N	lethod		
9-5/8"	36	0-3,450	3.450		12.25"	Ot	her			
4-1/2"	10.5	0-4,465	4.465		7.875**		20077.			
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Approval Expires 11/30/2014

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Well S	iLR1, Future	Gen 2.0, Morg	an County, I	t			Gen Al ntral Pa		ist, Jackson	/ille, IL 626	50	
	cate Well and	Outline Unit of	1	Sta 111	te inois		- 000	ounty forgan		Permit	Number	
250		N	-000-00-110	2000	face Location	and the same of		-	ACCOMUNICATION	4	anama (L.C.)	green.
w =	- - -	- - - - - -		Lo Su Lo and	ft. from	rm (N-S)	ns from	nearest line	es of quarter	WELL /		
(##		1000	Rule	1			□ E □ H □ CLAS		covery	
				L+s	se Name				Well Num	-		
		ASING AND TU	BING RECORD	AFTER PLU	COINC			METH	OD OF EMPL	ACEMENT O	F CEMENT P	LUGS
SIZE	WT (LB/FT	TO BE PUT	IN WELL (FT)	TO BE LEF	T IN WELL (FT)	HOLE	SIZE	☑ Th				
20"	94	0-150		150		26"		Th	e Dump Saile	r Method		
13-3/8	61	0-600		600		17.5"		□ Th	e Two-Plug N	lethod		
9-5/8"	36	0-3,450		3.450	12.25" Other							
5-1/2"	17	0~4,150		4,150		8"		1000	8577.			
	CEMENTI	NG TO PLUG AN	D ABANDON D	ATA:	PLUG	At PL	UG #2	PLUG #3	PLUG #4	PLUC 45	PLUG A6	PLUG #1
Bize of I	Hole or Pipe I	n which Plug W	ill Be Placed (inche	5-1/2°	5-1	/2"			3,000		
Depth to	Bottom of T	ubing or Drill P	ipe (ft		4,150	3.5	00'				1 1	
Backs of	f Cement To E	le Used (each p	lug)		78	388	3					
Slurry V	otuma To Be	Pumped (cu. ft.	()		87	451	1					
Calculat	ed Top of Plu	g (ft.)			3,500	0.						
Measure	d Top of Plug	(if tagged ft.)			3,500	0'						
Slurry W	/t. (Lb./Cal.)				15.82	15.	6					
Type Ce	ment or Othe	r Material (Class	(11)		EverC	ret Cla	se A			1		1
	- 1	IST ALL OPEN	HOLE AND/OR	PERFORATE	D INTERVALS	AND INTE	RVALS	WHERE CAS	ING WILL BE	VARIED (if a	iny)	
	From			To				From			To	
4000"			4100' (per	orated and	fractured)	1						
					- 1							
-		CONTRACTOR										
\$536,6	ed Cost to Pla 500	g Wells										
at	tachments ar formation is	he penalty of is d that, based o rue, accurate, s	n my inquiry o	f those indi-	iduals immedi that there are t	tamiliar	ponsible	e for obtaining	ng the inform	ation, I beli	eve that the	e .
pe	essenity of the	the area surprises	oncerne press,		4)							

₽E	PA	P	United St	Washington	DC 204	80		AN			
900,000,000	d Address of F LR2, Puture G				Name an	d Addr	ess of Owne	Operator	ville, IL 626	50	
	cate Well and C		Sta	nois		C	ounty forgan			Number	
	POST FIRE SHOT	757	Su	rface Location	Description	or					
		N I I I	nw.	1/4 of no 1/	4 of me	1/4 of	90 1/4 of	Section 25	Township	16n Range	9w
* -	 - - - - - - - - - -		E E	tt. from (m (N-S) E-W)	Line	ne of quarter of quarter se	section ction.	WELL /	ACTIVITY	
F	 	- - - -		umber of Wells	1				nhanced Re lydrocarbon	covery	
- St		s	J L+s	see Name				Well Num	ss III ber		
	CA	SING AND TUBING REC	ORD AFTER PLU	IOOING			METH	OD OF EMPL	ACEMENT O	F CEMENT P	LUCS
SIZE	WT (LB/FT)	TO BE PUT IN WELL (F	TI TO BE LEF	T IN WELL (FT)	HOLE	SIZE	[7] to	e Balance Me			
24"	140	0-132	132		30"		annie .	e Barance IXX e Dump Baile			
16"	84	0-556	556		20"		-	e Dump Ball e Two-Plug N			
10-3/4	51	0-3.934	3.934		14.75	recipe					
7"	29	4.150	4,150		9.5"		☐ OH				
	CEMENTING	TO PLUG AND ABANDO	N DATA:	PLUG	T PLU	IG #2	PLUG #3	PLUG #4	PLUC #5	PLUG #6	PLUG #T
Size of I	folie or Pipe in	which Plug Will Be Plac	ed (inche	7"	7"	-					
Depth to	Bottom of Tub	ling or Drill Pipe (ft		4,150	3,50	10'				1	
Backs of	Cement To Be	Used (each plug)		124	619						
Slurry V	otuma To Be Pi	imped (cu. ft.)		139	730						
Calculat	ed Top of Plug	(ft.)		3,500	0.						
Measure	d Top of Plug (if tagged ft.)		3,500	0,						
Sturry W	rt. (Lb./Gal.)			15.82	15.6	5					
Type Ce	ment or Other f	daterial (Class III)		EverO	ret Cla	88 A					
3	Lis	IT ALL OPEN HOLE AND	OR PERFORATE	D INTERVALS	AND INTE	RVALS	WHERE CAS	ING WILL BE	VARIED (if a	iny)	
	From		To				From			To	
4000		4100' (perforated and)	fractured)							
	4 5 - 14 1 1 1	W.W.									
\$571,6	ed Cost to Plug 600	Wells									
at in	tachments and formation is tru	e penaity of law that I ha that, based on my inqui le, accurate, and comple and imprisonment. (R	iry of those indiv etc. I am aware t	viduals immedia that there are s	familiar	onsibl	e for obtaining	ng the inform	ration, I beli	eve that the	
Name ar	ed Official Title	(Please type or print)	2111	Signature	90 22	0-51 m		0.00		Date Signed	E .
Kennel	h K. Humphre	rys, Chief Executive O	fficer	28	net	1 7	of the	nder	1.5	03/03/201	13

						OMB No. 2040-	0042 Ap	proval Expire	is 11/30/2014	5		
₽E	PA	PI I	United States	Vashington	DC 20460		ΔN					
Name an	d Address of F		, CO			dress of Owne						
4000000		eGen 2.0, Morgan County	,IL		FutureGen		posterior	ville, IL 626	550			
	rate Well and C		State	. 1		County		Permit	Number			
Sec	ction Plat - 640 /	Acres	Li,	Location (Securiation	magan						
-		N T T T T	process.	pressure.	gentaling	af 90 1/4 of	Section 26	Township	16n Range	9w		
-	#= - - -		Surface Location	n ft. fr	m (N-S)	Line of quarter te of quarter se	section	27774000743728	drilling unit) () () () () () () () () () (
* -	 	F	Ar	dividual Pe rea Pennit ule er of Wells				SS II Irine Dispos Inhanced Re Iydrocarbon SS III	covery			
				Lease Name				-				
	CA	SING AND TUBING RECOR	D AFTER PLUGGI	NO			OD OF EMPL	ACEMENT O	F CEMENT P	LUGS		
BIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN	WELL (FT)	HOLE SIZ	E Th	e Balance M	Method				
16"	5.5	0-150	150		20"	Th	e Dump Bail	er Method				
10-3/4	-	0-600	600		14.75"	Th	e Two-Plug N	Nethod				
5-1/2"	17	0-2,000	2,000	0 9.5" Other								
	CEMENTING	TO PLUG AND ABANDON D	ATA:	PLUGA	1 PLUG	2 PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7		
Bize of h	lale or Pipe in	which Plug Will Be Placed	inche	9,5"	5.5"			1				
Depth to	Bettom of Tub	sing or Drill Pipe (ft		2,000	1,880'				ŧ.			
Backs of	Cement To Be	Used (each plug)		56	209							
Slurry V	oluma To Be Pi	umped (cu. ft.)		63	246							
	ed Top of Plug	Contract of the Contract of th		1,880	0							
-	d Top of Plug (if tagged ft.)		1,880'	0							
	it (Lb/Gal.)			15.6	15.6							
Type Ce		daterial (Class III)		Class A	_							
3		ST ALL OPEN HOLE AND/OR		TERVALS A	ND INTERVA		ING WILL BE	VARIED (if				
-	From	1	To			From	_		To			
2.000		1,880' (per					\rightarrow					
1,930		1,950' (scr	eened)	-			-					
Estimate 2319,0	ed Cost to Plug 100	Wells										
at im po	tachments and formation is tru essibility of fine	e penalty of law that I have that, based on my inquiry us, accurate, and complete, a and imprisonment. (Ref. of	of those individual I am aware that 40 CFR 144.32)	us immedia there are si	familiar with	ible for obtaini	ng the inform	ration, I bell	eve that the including the	•		
		(Please type or print)		gnature	111	H Han		2	Date Signed			
Kennet	h K. Humphre	eys, Chief Executive Office	er	11-	HACK.	- 1 - 1 - and	- series	, etc.	03/03/2014	4		

θE	PA		PLU	United States I W IGGING AN	ashington	DC 20460		AN			
donner .	d Address of 1S1, Future	Facility 3en 2.0, Morgan	ı County, IL	<u> </u>		FutureGen	idress of Owne Alliance Park Plaza E		ville, IL 626	50	
400		Outline Unit on		State			County		Permit	Number	
	tion Plat - 64			Illinois			Morgan				
_		N		and the same of	phenology	Description 4 of no 1/4 o	1 11W 1/4 of	Section 27	Township	16n Range	9w
-	 	0 +-	-+- -+- -+-	Locate v Surface Location and	ft. from (nn (N-S)	oin nearest lin Line of quarte e of quarter se	rsection	2774000543525	alor Sarr	Š
* =	 	s		☐ AN	lividual Pe ea Permit le er of Wells		TON:		SS I IS II Irine Dispos Inhanced Re Iydrocarbon ISS III	covery	
	- 3	CASING AND TUE	ING RECORD	AFTER PLUGGIN	10		METH	OD OF EMPL	ACEMENT O	F CEMENT P	LUGS
SIZE	WT (LB/FT	TO BE PUT IN	WELL (FT)	TO BE LEFT IN V	VELL (FT)	HOLE SIZ	E [7] **	e Balance Me			
13-3/8	54	0-130		130		17.5"	-	e Dump Saile			
7-5/8	26.4	0-350		350		11.5"	m	e Two-Plug N			
		10					4	her			
	CEMENTI	NG TO PLUG AND	ABANDON DA	ITA:	PLUG	1 PLUG #	PLUG #3	PLUG #4	PLUC #5	PLUG #6	PLUG #7
Bize of h	lale or Pipe I	n which Plug Wil	Be Placed (inche	7-5/8"					-	
Depth to	Bottom of T	ubing or Drill Pip	e (ft.		330						
Backs of	Cement To I	Be Used (each plu	(g)		74						
Slurry V	otuma To Be	Pumped (cu. ft.)			87						
	ed Top of Piu				0		3				
-		(if tagged ft.)			0						
_	t. (Lb/Gal.)				15.6	-					
Type Ce		r Material (Class I	-		Class /	_					
			OLE AND/OR	PERFORATED INT	ERVALS A	ND INTERVAL		ING WILL BE	VARIED (if a		
	From	¥		To			From	_		To	
_		- 3	-					\rightarrow			
-			-		-	-		\rightarrow			
\vdash			-		\rightarrow			\rightarrow			
Estimate	d Cost to Pli	g Wells									
\$25,00	0	et rovogar									
att	tachments ar	nd that, based on	my inquiry o	ersonally examin f those individual	s immedia	familiar with	ble for obtain	ng the inform	ration, I bell	eve that the	
po	ssibility of f	ne and imprison	nent. (Ref. 4			ignificant pen	alties for sub-	utting false i	nformation,		
Name ar	of Official Tit	le (Piease type o	r nrindi	Sie	mature					Date Signed	67

Kneth K Hamphrage

EPA Form 7520-14 (Rev. 12-11)

Kenneth K. Humphreys, Chief Executive Officer

₽E	PA		PLU	United States	Washington.	DC 2046	0		AN				
Name an	d Address of F	acility				Name and	Addr	ess of Owne	Operator				
400000000000000000000000000000000000000		m 2.0, Morgan C	County, IL			FutureG	en Al			ville, IL 626	50		
	cate Well and C			State Illinoi	8	1	1000	ounty forgan		Permit	Number		
10-12-12-12				Surface	Location D	escriptio	r						
	111	111	7	8W 1/4	4 of SW 1.4	of sw 1	/4 af	EW 1/4 of	Section 31	Township	16n Range	9w	
w =			Surface Location and / In	TYPE OF AUTHORIZATION WE Individual Pennit						WELL ACTIVITY			
-	1-1-1			Numb	er of Wells	1			and the second	ly dro carbon			
4	1								CLAS	SS III	00000		
0		s							Well Num	441			
		SING AND TUBIN		Lease						ACEMENT O		8023	
13-3/8 7-5/8	WT (LB/FT) 54 26.4	0-130 0-350	ELE (FT)	TO BE LEFT IN 130 350	WELL (FT)	17.5" 11.5"		The Balance Method The Dump Bailer Method The Two-Plug Method Other					
	CENERAIN	TO PLUG AND A	PANIDON DO	TA:	PLUG #	1 PLU	0.44	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7	
Size of b	11-07-70-70-70-70-70-70-70-70-70-70-70-70-	which Plug Will B		00.07	7-5/8"	PLO	9 112	PLUG PO	PL00 //4	PL00 40	PLUG NG	PLOG PI	
-		ing or Drill Pipe	-		330	_							
PARTY NAMED IN	THE RESERVE AND ADDRESS OF THE PARTY OF THE	Used (each plug)	-		74								
Slurry V	otume To Be Pi	umped (cu. ft.)			87	9 1							
Calculat	ed Top of Plug	(ft.)			0								
Measure	d Top of Plug (if tagged ft.)			0								
_	rt. (Lb./Gal.)				15.6								
Type Cer	ment or Other I	risterial (Class III)			Class A								
	-	ST ALL OPEN HOL	E AND/OR F	A17 - 3300 - 31	TERVALS A	ND INTER	VALS		ING WILL BE	VARIED (if a		-	
	From			To				From			To		
					- 3				_				
					-	_						_	
		-			-				\rightarrow				
Estimate	ed Cost to Plug	Wells											
\$25,00		ACAGENT											
att	tachments and formation is tru	e penalty of law tr that, based on m re, accurate, and a and imprisonme	y inquiry of complete.	those individual am aware that	als immedia	familiar v	nsible	e for obtaining	ng the inform	ration, I belle	eve that the		
Name an	nd Official Title	(Please type or p	rinti	Isi	gnature					Т	Date Signed		
		eys, Chief Execu				1.1	-	1 1/2	und.		03/03/2014		
Secretary 24		A - A - A - A - A - A - A - A - A - A -				atest.		E. C. C.	/	1	A 20 0 20 20 12	57	

₽E	PA	PI I	United States	Vashington	DC 20460		AN				
decision and	nd Address of F MS3, FutureGe				Name and A FutureGen	ddress of Owne	r/Operator	ville, IL 626	550		
	cate Well and C		State	8		County		Permit	it Number		
50	ction Plat - 640 /	ACTES	Surface	Location (Description						
Г	111	1 1 1 1	ne. 1/4	t of 50 14	4 of ne 1/4	af HW 1/4 of	Section 25	Township	16n Range	9w	
* -	+		Surface Location and	n ft. from (i TYPE OF dividual Peres Pennit	rin (N-S) E-W) Li AUTHORIZA	Line of quarter section Line of quarter section Line of quarter section Line of quarter section CATION WELL ACTIVITY CLASS I CLASS II Brine Disposal Enhanced Recovery Hydrocarbon Storage					
50=		s	Lease N	ame			Well Num	ber			
	CA	SING AND TUBING RECOR	D AFTER PLUGGI	NG		METH	OD OF EMP	ACEMENT O	FCEMENTP	LUGS	
SIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN	WELL (FT)	HOLE SE	E Z Th	e Balance M	thed			
13-3/8	54	0-130	130		17.5"	gently .	e Dump Bail	13 13 10 mm			
7-5/8	26.4	0-350	350		11.5**		e Two-Plug N				
						Ot	her				
			1	_	1						
	11-57-77-75-75-75	TO PLUG AND ABANDON D	900	PLUGA	f PLUG	PLUG #3	PLUG #4	PLUC #5	PLUG #6	PLUG #7	
-	_	which Plug Will Be Placed	inche	7-5/8"							
PROPERTY AND PERSONS NAMED IN	CONTRACTOR CONTRACTOR	sing or Drill Pipe (ft		330	_	+				-	
_	otuma To Be Pi	Used (each plug)		87	_	_					
	ted Top of Plug			0	_	_				-	
	d Top of Plug (Control of the Contro		0	-						
-	Vt. (Lb./Gal.)			15.6							
Type Co	ment or Other f	Material (Class III)		Class /	1						
	Lis	T ALL OPEN HOLE AND/OR	PERFORATED IN	TERVALS A	ND INTERVA	LS WHERE CAS	ING WILL BE	VARIED (IT	arry)		
	From		To			From			To		
1											
Estimat	ed Cost to Plug	Wells									
\$2.5,00	and the second second	Wells.									
at isr p	tachments and formation is tru ossibility of fine	e penalty of law that I have that, based on my inquiry se, accurate, and complete, a and imprisonment. (Ref.	of those individua I am aware that 40 CFR 144.32)	us immedia there are si	familiar with	sible for obtaini	ng the inform	ration, I bell	eve that the including the		
Name a	nd Official Title	(Please type or print)	51	gnature	20 000	and the same	5) (9		Date Signed	E	
Kenne	th K. Humphre	eys, Chief Executive Offic	cer	8	nett	W. 7/	mple	26	03/03/201	4	

₽E	PA				ashington,	DC 20460	Agency MENT PL	AN				
Accessed to	d Address of F 1S4, FutureGe	actity n 2.0, Morgan Coun	ty, IL			FutureGen /	dress of Owne Alliance Park Plaza E		ville, IL 626	550		
Loc	ate Well and C	outline Unit on		State			County		Permit	Number		
	tion Plat - 640 /		_	Illinois			Morgan					
Е		N I I I	7	granning	of 5% 1/4	Spiritualing .	90 1/4 of	Section 34	Township	16n Range	9w	
-	 		-	Locate well in two directions from nearest lines of quarter section and drilling unit Surface Location ft. frm (N-S) Line of quarter section and ft. from (E/W) Line of quarter section.								
* =	 	s (+)	TYPE OF AUTHORIZATION Individual Permit Area Permit Rule Number of Wells			ON	OLAS	WELL ACTIVITY ASS I ASS II Brine Disposal Enhanced Recovery Hydrocarbon Storage ASS III				
	CA	SING AND TUBING RE	CORD AFT	ER PLUGGIN	0		METH	OD OF EMPL	ACEMENT O	F CEMENT P	LUGS	
SIZE	WT (LB/FT)	TO BE PUT IN WELL	(FT) TO	BE LEFT IN W	(ELL (FT)	HOLE SIZE	[7] **	e Balance Me				
13-3/8	54	0-130	130			17.5"	March .	ne Dump Sailer Method ne Two-Plug Method ther				
7-5/8	26.4	0-350	350		-	11.5**	☐ Th					
		ST.			7			2017.				
	1150000000000	TO PLUG AND ABAND	10.010.00		PLUG A	PLUG #2	PLUG #3	PLUG #4	PLUC #5	PLUG #6	PLUG #7	
		which Plug Will Be Pl	aced (inche	6	7-5/8"							
-	THE RESERVE AND ADDRESS OF THE PARTY OF THE	ing or Drill Pipe (ft.			330		_				_	
-		Used (each plug)			74	_	_					
	stume To Be Pi				87		-			-	_	
	ed Top of Plug				0		-	_			-	
-	t (Lb/Gal.)	л саддео п. ј			15.6	+	+				_	
		daterial (Class III)			Class A	+-	+	_		-	-	
Type ce					-						_	
	From	IT ALL OPEN HOLE AN	O OR PERF	To DRATED INT	ERVALS A	ND INTERVAL	From	ING WILL BE	VARIED (IT	To To		
1		11			- 1							
L.												
\$25,00	d Cost to Plug ()	Wells										
act	achments and ormation is tru	e penalty of law that I that, based on my inq ie, accurate, and comp and imprisonment.	puiry of the plete. I am	nally examine se individuals aware that the	s immediat	familiar with ely responsil	ble for obtaini	ng the inform	nation, I bell	eve that the		

Knett H Hundreys

EPA Form 7520-14 (Rev. 12-11)

Kenneth K. Humphreys, Chief Executive Officer

DMB No. 2040-0042 Approval Expires 11/30/2014 United States Environmental Protection Agency Washington, DC 20460 PLUGGING AND ABANDONMENT PLAN Name and Address of Facility Name and Address of Owner/Operator Well MS5, FutureGen 2.0, Morgan County, IL FutureGen Alliance 73 Central Park Plaza East, Jacksonville, IL 62650 Permit Number Locate Well and Outline Unit on Illinois Morgan Section Plat - 640 Acres Surface Location Description 8W 1/4 of 8W 1/4 of 8W 1/4 of 90 1/4 of Section 26 Township 168 Range 9W Locate well in two directions from nearest lines of quarter section and drilling unit Location ft. frm (N.S) Line of quarter section ft. from (E/W) Line of quarter section. TYPE OF AUTHORIZATION WELL ACTIVITY CLASS I / Individual Permit Area Pennit CLASS II Rule Brine Disposal Enhanced Recovery Number of Wells 1 Hydrocarbon Storage CLASS III Lease Name Well Number METHOD OF EMPLACEMENT OF CEMENT PLUGS CASING AND TUBING RECORD AFTER PLUGGING WT (LB/FT) TO BE PUT IN WELL (FT) TO BE LEFT IN WELL (FT) HOLE SIZE √ The Balance Method 13-3/8 54 The Dump Bailer Method 7-5/8 26.4 0-350350 11.5 The Two-Plug Method Other CEMENTING TO PLUG AND ABANDON DATA: PLUG #2 PLUG #1 PLUG #3 PLUG #4 PLUG #5 PLUG #6 PLUG #7 Size of Hole or Pipe in which Plug Will Be Placed (inche Depth to Bottom of Tubing or Drill Pipe (ft 330 Sacks of Cement To Be Used (each plug) 74 Slurry Volume To Be Pumped (cu. ft.) Calculated Top of Plug (ft.) Measured Top of Plug (if tagged ft.) Slurry Wt. (Lb./Cal.) Type Cement or Other Material (Class III) LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (if any) From Tó Estimated Cost to Plug Wells \$25,000 Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the

Hutt H Handwargh

Signature

EPA Form 7520-14 (Rev. 12-11)

Name and Official Title (Please type or print)

Kenneth K. Humphreys, Chief Executive Officer

possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

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		PLI	JGGING AN	ID ABA	ANDONN	IENT PL	AN					
400000	d Address of F M1, FutureGe	en 2.0, Morgan County, I	L		FutureGen A			ille II. 626	50			
_			State		-	ounty			nit Number			
		Outline Unit on	3000000	Illinois Morgan								
20	tion Plat - 640 /	ACTES	Surface	Location D	escription							
Г	111	1	80 1/4	of 80 1/4	of ne 1/4 of	11W 1.4 of	Section 27	Township	16n Range	9w		
* -		(Surface Location and V Ind Are	ft. from (I TYPE OF lividual Per sa Pennit	E/W) Line AUTHORIZATION IN It	ine of quarter of quarter se	section ction.	WELL /	ACTIVITY al covery			
Ļ	$1 \perp 1$						Secretary Control	99 III	now-tarke of			
		\$	Lease N	ame			Well Num	per				
_	CA	SING AND TUBING RECOR				METH	OD OF EMPL		F CEMENT P	LUCS		
SIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)			HOLE SIZE							
7-5/8	26.4	0-20	20			a = '''	e Balance Mo e Dump Baile					
7.576	2011	W.WV.	-		11.5"	1	e Dump Balle e Two-Plug N					
				_		7 on		ieuwa				
		1	1			1						
	CEMENTING	TO PLUG AND ABANDON D	ATA:	PLUG A	1 PLUG /2	PLUG #3	PLUG #4	PLUC #5	PLUG #6	PLUG #1		
Bize of I	lale or Pipe in	which Plug Will Be Placed	(inche	7-5/8"				1	100000000	-		
Depth to	Bottom of Tub	oing or Drill Pipe (ft		20								
Backs o	Cement To Be	Used (each plug)		4								
Slurry V	oluma To Be Pi	umped (cu. ft.)		.5								
Calculat	ed Top of Plug	(ft.)		0								
Measure	d Top of Plug (if tagged ft.)		0								
Slurry W	t. (Lb./Gal.)			15.6								
Type Ce	ment or Other f	Material (Class III)		Class A				1		1		
	Lis	ST ALL OPEN HOLE AND OF	R PERFORATED INT	ERVALS A	NO INTERVALS	WHERE CAS	ING WILL BE	VARIED (if a	arry)			
	From		To			From			To			
		3 L		- 3								
-												
\$2,000	ed Cost to Plug	Wells										
at	tachments and formation is tru	e penalty of law that I have that, based on my inquiry se, accurate, and complete a and imprisonment. (Ref.	of those individual I am aware that t	s immedia	familiar with t	le for obtaini	ng the inform	ation, I beli	eve that the			
Name ar	d Official Title	(Please type or print)	Sig	nature		- 11			Date Signed	6		
		eys, Chief Executive Offi		Ka	ett H	Hum	Lungs		03/03/201			
- comit	- sec estimpent	And the same of th		Sections		1	1		2.003(2011)	5.7		

≎EPA PLUG		ashington,			AN					
lame and Address of Facility Well TM2, FutureGen 2.0, Morgan County, IL		1 1	FutureGen Al 73 Central P	lliance		ville, 11. 626	50			
Locate Well and Outline Unit on	State		1 000	ounty		Permit	Number			
Section Plat - 640 Acres	Illinois			Aorgan						
<u> </u>	greening	Lecation D of SW 1/4	escription of SW 1/4 of	EW 1/4 of	Section 31	Township	16n Range	9w		
- - - - - - - - - - 	Surface	Location ft. frm (N/S) Line of quarter section								
WE	Are Rul	TYPE OF AUTHORIZATION Individual Permit				3\$ II Brine Disposal Enhanced Recovery Hydrocarbon Storage SS III				
CASING AND TUBING RECORD A	AFTER PLUGGIN	o		METH	OD OF EMPL	ACEMENT O	F CEMENT P	LUCS		
	TO BE LEFT IN W	VELL (FT)	HOLE SIZE	Th	e Balance Me e Dump Balle e Two-Plug M er	r Method				
CEMENTING TO PLUG AND ABANDON DATA	A:	PLUG A	PLUG #2	PLUG #3	PLUG #4	PLUC #5	PLUG #6	PLUG #		
ize of Hole or Pipe in which Plug Will Be Placed (in		7-5/8**								
epth to Bottom of Tubing or Drill Pipe (ft		20								
acks of Cement To Be Used (each plug)		4								
lurry Volume To Be Pumped (cu. ft.)		.5						4		
alculated Top of Plug (ft.)		0								
feasured Top of Plug (if tagged ft.)		0								
lurry Wt. (Lb/Gal.)		15.6								
ype Cement or Other Material (Class III)		Class A								
LIST ALL OPEN HOLE AND/OR PE	To To	ERVALS A	ND INTERVALS	From	ING WILL BE	VARIED (if a	To			
		310								
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stimated Cost to Plug Wells										
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I certify under the penalty of law that I have per		Certific		7945 M	1000	ia vad	0 00			

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EPA Form 7520-14 (Rev. 12-11)

Kenneth K. Humphreys, Chief Executive Officer

₽E	PA		DI II	United States	Washington	DC 2046	0		AN					
4000000	d Address of Fi M3, FutureGe	n 2.0, Morgan		GGING AI		Name and	i Addr	ess of Owne	r/Operator	ville, IL 626	50			
i nass	Section Experiences	26,10400044616264		State		1	To	ounty	I STORES	Permit	Permit Number			
	ate Well and O tion Plat - 640 A			Illinoi	8	Morgan								
		12		Surface	Location (Descriptio	r			-				
	111	1 1 1		DC 1/	4 of 50 1.4	e of ne	/4 af	11W 1.4 of	Section 25	Township	16n Range	9w		
* = -	†= -+ ₁ += -+- - -+-	3 † † †	- -	Surface Location	n ft. from (m (N/S)	Line	The Concessor of						
				□ A	/ Individual Permit Area Permit Rule Number of Wells 1				CLASS I CLASS II Brine Disposal Enhanced Recovery Hydrocarbon Storage CLASS III					
_	CA	SING AND TUB	NO RECORD					METH	OD OF EMPL	ACEMENT O	E CEMENT P	LUOS		
51ZE (7-5/8	WT (LB/FT) 26.4	TO BE PUT IN 0-20	O AND TUBING RECORD AFTER PLUGGING D BE PUT IN WELL (FT) TO BE LEFT IN W 20 20				SIZE	Th	ethod Ier Method Method					
	CEMENTING	TO PLUG AND A	BANDON DA	TA-	PLUG	t PLU	Q #2	PLUG #3	PLUG #4	PLUC #5	PLUG A6	PLUG #		
Bize of H		which Plug Will		7577	7-5/8"	1 720	4	7 200 10	7200 114	7 200 10	1100 10	12001		
		ing or Drill Pipe			20									
Backs of	Cement To Be	Used (each plug	10		4									
Slurry Vo	tuma To Be Pu	mped (cu. ft.)			5									
	ed Top of Plug				0									
	d Top of Plug (i	f tagged ft.)			0	_	_							
	t. (Lb/Cal.)	taterial (Class III			15.6	_	_							
Type Cer		_			Class /	-			and the same of the	111 505 50 10		1		
	From	T ALL OPEN HO	LE AND OK	PERFORATED IN	TERVALS A	ND INTER	VALS	From	ING WILL BE	VARIED (IT	To To			
	P.C. Sellin	- 1		. 10	-			FTOM			19			
		-				()								
\$2,000	d Cost to Plug	Wells												
	W ACTO	F 32 4			Certific	ation	-,	G-70 374			72 22			
att	achments and ormation is tru	that, based on I	my inquiry of complete.	ersonally exami those individual I am aware that	ned and am als immedia	familiar v	ensibl	e for obtaining	ng the inform	ration, I bell	eve that the			

Signature Knoth H Hangdrays

EPA Form 7520-14 (Rev. 12-11)

Name and Official Title (Please type or print)

Kenneth K. Humphreys, Chief Executive Officer

Date Signed

₽E	PA	Di		ashington	DC 20460		A N1					
900,000,000	nd Address of F 454, FutureGo		UGGING AN		Name and Add FutureGen A	ress of Owne						
0.000					73 Central F	ark Piaza Ea	ist, Jacksons	ille, IL 626	550			
100	esta Wall sad f	Outline Unit on	State			ounty		Permit	Number			
	ction Plat - 640		14	Illinois Morgan Surface Location Description								
_		N .	gravenia .	phenology	escription of SW 1/4 of	90 1/4 of	Section 34	Township	16n Range	9w		
	 - - - - - - - - - -	 	Surface Location and	ft. from (I	E/W)Line	ine of quarter of quarter se	section ction.	WELL	drilling unit			
E	 	+ ++++	☐ AN	er of Wells		CLASS I CLASS II Brine Disposal Enhanced Recove Hydrocarbon Sto						
		57 3000	Lease N	-		Well Number						
		SING AND TUBING RECO				METH	THOD OF EMPLACEMENT OF CEMENT PLUGS					
91ZE 7-5/8	WT (LB/FT) 26.4	TO BE PUT IN WELL (FT)	TO BE LEFT IN V	T IN WELL (FT) HOLE SIZE			The Balance Method The Dump Bailer Method The Two-Plug Method Other					
	11.50	TO PLUG AND ABANDON	724,000	PLUG #	1 PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #1		
		which Plug Will Be Placed bing or Drill Pipe (ft	(inche	7-5/8"	-	-		_	-	-		
-	CONTRACT CONTRACTOR	Used (each plug)		4	_	1				-		
_	otume To Be Pi			5	-					_		
	ed Top of Plug			0	_							
Measure	d Top of Plug ((if tagged ft.)		0								
Slurry 9	ft. (Lb./Gal.)			15.6								
Type Ce	ment or Other f	Material (Class III)		Class A				11 1		1		
	Lit From	ST ALL OPEN HOLE AND/O	R PERFORATED INT	ERVALS A	ND INTERVALS	WHERE CAS	ING WILL BE	VARIED (if I	arry) To			
				- 3								
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\$2,000	ed Cost to Plug)	Wells										
at	tachments and formation is tru	e penalty of law that I have that, based on my inquiry ue, accurate, and complete a and imprisonment. (Ref	of those individual . I am aware that t	is immedia	familiar with t	le for obtainir	ng the inform	ation, I beli	eve that the			
				no abure					Onto Sings			
		(Please type or print)		mature	11	/	,		Date Signed			
	in K. Hitimphre	eys, Chief Executive Off	icer	28.00	ell ×	Mary	of the english		03/03/2014	43		

₽E	PA	PI I	United States I W JGGING AN	ashington	DC 20460		ΔN						
9 20 4 70 4 10 1	d Address of F 155, FutureGe				Name and Add FutureGen A 73 Central F	ress of Owne	r/Operator	rille, IL 626	50				
Lo	ate Well and C	outline Unit on	State			ounty		Permit	Number				
	tion Plat - 640		L	Illinois Morgan									
_		N .	and the same of th	paramong	of SW 1/4 of	90 1/4 of	Section 26	Township	16n Range	9w			
w =	 - - - - - - - - - -		Surface Location and	ft. from (I TYPE OF	E/W)Line	ine of quarter of quarter se	section	WELL /	drilling unit	Š			
E		⊕	Numbe	or of Wells	1		al covery Storage						
_	-	CINC AND THEMS DECOR	Lease No			L	OD OF EMPLACEMENT OF CEMENT PLUGS						
SIZE	WT (LB/FT)	SING AND TUBING RECOR	TO BE LEFT IN W		HOLE SIZE								
7-5/8	26.4	0-20	20		11.5"	The Dump Bailer Method The Two-Plug Method Other							
	CEMENTING	TO PLUG AND ABANDON D.	ATA:	PLUG A	1 PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7			
		which Plug Will Be Placed	inche	7-5/8"									
Married World	THE RESERVE AND ADDRESS OF THE PARTY.	sing or Drill Pipe (ft		2.0									
_		Used (each plug)		4	_					_			
	olume To Be Pi ed Top of Plug			5	_								
	d Top of Plug (Control of the Contro		0	-	-							
_	t. (Lb./Gal.)	in collidate (c)		15.6	-	1							
		daterial (Class III)		Class A				1					
	ĹIS	ST ALL OPEN HOLE AND/OR	PERFORATED INT	_		WHERE CAS	ING WILL BE	VARIED OF	(mr)				
	From		To			From	I	Treatment (in a	To				
				- 3									
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att	tachments and formation is tru	e penalty of law that I have that, based on my inquiry se, accurate, and complete, a and imprisonment. (Ref.	personally examine of those individual I am aware that the	s immedia	familiar with t	le for obtaini	ng the inform	ation, I beli	eve that the				
Name 20	d Official Title	(Please type or print)	Sie	nature					Date Signed	6			
		eys, Chief Executive Offic		2/	ett si	Home	Lucy						
	er ex. collections	yo, Chief Executive Offic	X1.	4 3 -45	- F-F-		1		03/03/2014	£0			